ANNUAL REPORT FOR 1930

Northern Rocky Mountain Forest and Range Experiment Station
Missoula, Montana

June 19, 1931.

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ANNUAL REPORT FOR 1930
and
PROGRAM FOR 1931
of the
REGION I INVESTIGATIVE COUNCIL

For the Investigative Council

Evan W. Kelley
Chairman

Approved June 24, 1931

Evan W. Kelley
Regional Forester

R.H. Weidman
Secretary

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ANNUAL REPORT OF THE REGION I INVESTIGATIVE COUNCIL FOR 1930 AND PROGRAM FOR 1931

The annual meeting of representatives of all agencies engaged in forest research in the northern Rocky Mountain region was held this year in the Chamber of Commerce building, Spokane, Washington, on January 9 and 10. The various federal agencies, the forest schools and the private operators were all represented at this meeting and the present report, intended primarily to cover the work of the Experiment Station and other Forest Service offices in the region, also includes the results of the research being done by the other agencies.

PERSONNEL OF THE COUNCIL

Eight forest agencies were represented at this council meeting and the following men attended all or part of the sessions:

U. S. Forest Service: E. W. Kelley, chairman; R. H. Weidman, secretary; Elers Koch, T. Lommasson, M. I. Bradner, D. S. Olson, F. J. Jefferson, H. T. Gisborne, I. T. Haig, M. H. Wolff, and John McLaren.

Forest Schools: Dean T. C. Spaulding, Dr. C. A. Schenck and Professor J. H. Ramskill of the University of Montana; and Dr. E. E. Hubert of the University of Idaho.

Office of Blister Rust Control: S. N. Wyckoff, H. N. Putnam, Kermit Miller, C. C. Strong and H. R. Offord.

Indian Forest Service: Lee Muck.

Consulting Foresters: D. T. Mason, Mason and Stevens; and N. G. Jacobson, Western Forestry and Conservation Association.

Private Timber Operators: A. A. Segersten, Potlatch Lumber Co.; E. W. Thorpe, Secretary, Timber Products Bureau, Spokane Chamber of Commerce; A. Whisnant, Secretary, Pacific Logging Congress.

Weather Bureau: E. M. Keyser, F. C. Crombie.

Bureau of Entomology: J. C. Evenden.

British Columbia Forest Service: G. P. Melrose.

MATTERS OF GENERAL INVESTIGATIVE POLICY

Extent of Regional Research in 1930

Six agencies reported 120 research projects in progress during the year, as follows: Forest Service, 62; University of Montana, 19; University of Idaho, 18; Bureau of Entomology, 10; Office of Blister Rust Control, 7; and Weather Bureau, 4.

The total expenditure on regional research in forestry amounted to $128,132. The amounts spent by each agency by lines of work are shown in the accompanying table.

Selection and Designation of Experimental Forests

Definite progress was made during the year in the examination and setting aside of experimental forests in the northern Rocky Mountain region. To begin with, the subregions in which the experimental areas should be located have been reasonably

well defined for several years. Six such subregions have been recognized and up to last year suitable areas in four of them had been practically decided upon. Two of these, the Priest River and the Bernice areas, which have been in existence for some years, were definitely recommended during the winter and formally set aside and dedicated to research by the Forester under date of April 8, 1931.

Last summer field examination was made of three proposed areas in the Coeur d'Alene and three in the Clearwater subregions. Previous to last year other proposed areas, to the number of three, had been reconnoitered in these same subregions. The field work last year resulted in finding quite satisfactory areas in both localities. Before either of these areas, or the Coram and Little Trapper Creek areas (Larch-fir and western yellow pine subregions) can be recommended for approval, however, it will be necessary to do additional field work to determine definite information on boundaries required for the formal statement by the Forester which officially describes and designates the areas. It is hoped that boundary location of all four areas can be carried out during the coming field season.

When the above boundary work has been done, six experimental forests will have been selected--three representing different conditions in the western white pine type, and one each in the larch-fir, lodgepole and western yellow pine types. There has been some consideration lately of the need of locating

several additional experimental forests. The suggestions are for an additional area in lodgepole pine, one in the Engelmann spruce type represented by the Blackfeet-Flathead territory, and also a small area representing the radically different western yellow pine conditions in southeastern Montana. The plans for the present are to do first the field work in connection with boundary locations on areas already decided upon and later to give attention to the proposed additional areas.

Experimental Ranges

Entirely untouched so far has been the matter of locating experimental ranges in this region. A preliminary discussion last winter between Messrs. Koch, Smith, Wolff and Weidman tentatively indicated subregions, possible areas and procedure to be followed in reconnoitering and selecting areas. The possibility was discussed of finding an area or two within which both silvicultural and range research objectives could be combined. This would be particularly desirable in the case of the suggested experimental forest for western yellow pine on the Custer Forest and for the proposed additional lodgepole pine experimental forest. So far no field work in the location of experimental ranges is definitely planned for the coming field season.

Natural Areas

Activity in connection with natural areas for the preservation of virgin forest conditions was entirely incidental during the last year. Numerous areas have been considered and nine have been tentatively selected in the various forest types of the region. The selection has been largely on the basis of correspondence with Forest Supervisors. Before the areas and their boundaries can be fixed and described as required for formal designation by the Forester, they should be examined in the field to see whether they definitely meet the requirements. Koch and Weidman, who comprise the committee for selecting and recommending natural areas and experimental forests, have for the most part been able to give time to this work only as they could combine these objectives with field trips scheduled for other and more important work.

Need for Increased Funds for Regional Research

On July 1 this year forest research work in this Region will receive its first increase in funds in 10 years. The amount will be $45,000, of which $20,000 will be for starting the forest survey, $15,000 for fire research, and $10,000 for range research at the Ft. Keogh Livestock Experiment Station.

To meet the Regional needs adequately and in conformity with the program authorized by the McSweeney-McNary Act, additional funds should be made available during the next fiscal year. As a matter of fact, last year's estimate for increases called for exactly double the amount that is actually to be received July 1 this year. The entire program of work then deemed necessary for starting has the same reasons to support it now as then and the funds to get it under way should, therefore, be provided by July 1, 1932, along with additional money for several new lines of endeavor which should, in the logical development of Regional research, be commenced at that time. The recommended increases by classes of work are listed as follows in order of priority:

Class of Work	Recommended Increase effective July 1, 1932
Silvicultural studies	$20,000
Range research	25,000
Forest survey	15,000
Forest economics	5,000
Biological research	10,000
Erosion and streamflow studies	15,000

Silvicultural Studies The recommended increase of $20,000 is for projects dealing with methods of cutting, slash disposal and yields of western white pine forests and for preliminary studies of the same nature in the larch-fir forests.

The western white pine is one of the most valuable species in the United States. Sales have been made from the National Forests at stumpage prices of nearly $12 per M board feet, as compared with $1 to $3 for other species with which it is associated. About a third of the total lumber cut in the Northern Rocky Mountain region is of this species. The management problems of the white pine forests are among the most complex of the country. The number of competing species is large and they are more aggressive in reproducing themselves than the pine. An enormous amount of slash is left on the ground in cutting, which sometimes prevents the seed from germinating and in all cases creates a serious fire hazard. Broadcast burning of slash destroys the young growth and often creates conditions which prevent seedling establishment; piling and burning may cost as much as $35 per acre. Difficulties are enormously increased by the recent invasion of the white pine blister rust.

The larch-fir forest comprises the largest forest type in area in the Region and furnishes the greatest part of the lumber cut of Montana. Preliminary studies to indicate proper methods of cutting and regeneration and the yields to be expected are needed for National Forest and private timber operations. Nothing is being done in larch-fir forests now.

Silvicultural work for the fiscal year 1931, on which expenditures are to be approximately $13,000 will be confined to the northern portion of the white pine region, to the National Forests, and deals largely with restricted phases of methods of cutting and natural reforestation. It is proposed with the increase to do the following:

(1) To extend the work on methods of cutting and natural reforestation to the southern portion of the white pine region and to privately-owned lands on which conditions are different;

(2) To take up the question of white pine slash disposal on which the Experiment Station is doing nothing at present;

(3) To enlarge studies of growth and yields in white pine where expenditures are now less than $1,000 annually; and

(4) To conduct preliminary studies in the larch-fir forests as needed and as called for by current problems in National Forest and private cutting.

(5) To adequately undertake the working up of material in the files and now being accumulated. The Station has never had money for computing clerks and as a result office work is still behind field work and the preparation and publication of results has always been long and seriously delayed.

Range Research The increase of $25,000 is requested for investigation of grazing problems in the mountain ranges within and adjacent to the National Forests in the Region.

The $10,000 granted last year is solely for investigation of short grass ranges. This work is to be restricted to a portion of the Northern Great Plains, centered at and conducted in cooperation with the U. S. Livestock Experiment Station at Miles City, Montana. Activities there will be in cooperation with the Bureau of Animal Industry and the Montana Agricultural College.

The investigations provided for by the proposed increase will include the remaining major part of the region, where no work is now being done. These ranges support more than 1,000,000 sheep and 250,000 cattle during the summer grazing season, providing an annual income of $6,000,000 and representing an investment of $50,000,000 in land and livestock. Montana as a whole occupies fourth place in the country from the standpoint of cattle production.

Substantial reduction of grazing capacity in these mountain ranges and lessening of the weights of the stock grazed have resulted in decreased income. This has been due to faulty range management because of lack of definite information on how ranges should be managed in order to maintain their crop capacity. The determination of means of restoring depleted ranges to full producing condition and of the methods necessary to maintain full production

is of vital importance in insuring a stable income to livestock producers and in maintaining the watershed cover.

The work in the mountain ranges east of the Continental Divide will require the investigative activities of three men and the problems involved in developing the ranges of western Montana and northern Idaho to take care of the ever increasing bands of sheep shipped in from eastern Washington will require the efforts of two men.

Forest Survey The $20,000 granted last year is barely sufficient to get the inventory phase of the Survey under way. The increase of $15,000 recommended for July 1, 1932, is for starting the equally important aspects of the Survey dealing with growth and drain.

The economic welfare of the Region is largely based upon forest industries and the most valuable forest resources in private ownership, such as the western white pine, western yellow pine, and cedar are rapidly being depleted by cutting. Disastrous forest fires and the threat of white pine blister rust are contributing factors in the matter of depletion. Slash fires which prevent regrowth on cut-over lands also enter into the problem. The situation involves complex public and private owner relationships. It presents one of the very puzzling forest problems of the country. Investigation of all phases of the subject should be undertaken as soon as possible in order to obtain basic data necessary for effectively working out public and industrial forest

policies which will enable perpetuation of the resources and the industries. The situation in the Region is such that this work should be done at once.

Forest Economics A $5,000 increase is recommended for research in the financial aspects of timber growing in western white pine and western yellow pine forests.

The western white pine forests contain the highly prized white pine and cedar, but along with them a number of other species in mixture which have a very low or negative market value. Many private timber owners might be induced to practice a desirable type of selective logging and careful slash disposal with a view to holding their residual timber for a second cut, if the problem could be adequately investigated with a view to analyzing the economic aspects of logging, manufacture, protection and taxation along with the silvicultural features. A rapid rate of growth takes place in the white pine forests and much of the private timber land has a relatively high timber producing capacity.

Biological Research A $10,000 increase is proposed for investigations of wild life and its relationship to forest and range conditions. Two phases of this work are involved: one dealing with game animals and their place among the forest resources of the Region; and one dealing with rodents and lesser fauna which exert an important and often critical influence upon seed supplies and regeneration in the forest and upon grasses and other forage on range lands.

No work of this character is provided for by McSweeney-McNary funds in this Region at the present time. In order to attack one of the more urgent game problems, however, and purely as a temporary measure which may not continue beyond the present year, the Forest Service and the Game Department of Montana are cooperatively financing a forest officer in a study of elk problems in Yellowstone National Park and adjacent National Forests. Both the Park Service and the Biological Survey also cooperate in this project.

The Northern Rocky Mountain region is the largest remaining area of big game in the country. Deer, elk, moose, bighorn sheep, mountain goat, black and grizzly bear are still fairly plentiful. They are an important regional and national asset, not only from the standpoint of recreation and sportsmanship, but from the standpoint of preserving as a national heritage the wild life conditions which have been an intimate part of American frontier history from the days of Daniel Boone to the trail blazers of the West. The elk and in some cases other animals are now in conflict with livestock in the use of summer and winter ranges and are beginning to lose out in the struggle. The situation is very critical in the case of the elk and is a growing one in the case of deer. In this connection the Forest Service has been besieged by one of the most influential sportsmen's organizations in the country to close the entire Lewis & Clark Forest to grazing of livestock. The Regional Forester

considers the conflicting use of range by livestock and game animals as a very urgent problem about which something very definitely must be done in the near future. All of the game animals, but particularly the deer and elk, suffer serious losses from coyotes, cougars and other predatory animals. Adjustment and balance of wild life conditions is urgent and possible of attainment if provision is made for adequately studying the problems involved.

Rodents are a very important factor in reducing the available seed supply and thus contributing, along with such factors as infrequent seed years and dry summers, to the difficulties of establishing reproduction promptly after logging and forest fires. This is an acute problem in western yellow pine forests and is also important in white pine timber. Pocket gophers do serious damage to forest plantations. Gophers and ground squirrels are the cause of untold destruction of range resources.

Erosion and Streamflow Studies A $15,000 increase is needed for investigations of erosion and silting of streams constituting the headwaters of the Missouri River in eastern Montana.

The drainage of the Upper Missouri, including the Yellowstone, Musselshell, Milk, Marias, Sun, Tongue, Bighorn, and other rivers and their numerous tributaries, carries immense loads of silt to the Missouri each year. This

represents the eroded top soil of the plains, breaks, and foothills which is removed both by sheet erosion and by gullying. Gully erosion is particularly serious in the breaks country. Wind erosion is also a serious factor. A vast territory in eastern Montana is affected. The bulk of it is range land which obviously has an increasingly low stock carrying capacity due to the contributory influence of unrestricted grazing in preventing revegetation and fixing of the soil. Moreover, more than three million acres of the region is in abandoned dry farm lands where the situation sorely calls for re-establishment of plant cover. Important irrigation projects like Sun River, Milk River, Valier and others are dependent on clean water to prevent silting of the dams. Outside of these projects nearly every stream of any size in eastern Montana is used for irrigation. Soil and water are of first importance in this territory and much of both is being sacrificed each year.

This is the situation within the region. Outside, the influence of this erosion is that it enormously contributes to the silt load of the lower Missouri and Mississippi Rivers. Erosion research in the Badlands and other sections along the Missouri just outside Montana will be of little avail in this respect if study of the erosion in over a hundred thousand square miles of the headwaters region is neglected.

No work is now being done in this important field of research. If federal work is undertaken cooperation can be expected from the Montana Extension Service and Montana State College.

PROJECTS UNDER WAY OR PLANNED

The Council discussed each of the following lines of work in detail placing emphasis and confining discussion as far as possible to results, new work and correlation of efforts.

Artificial Reforestation

The year just closed has been a productive one from the standpoint of publication of results of past research dealing with artificial reforestation. Four contributions to the subject have made their appearance including Mr. Olson's Department Circular, "Growing Trees for Forest Planting in Montana and Idaho," and three articles by Mr. Wahlenberg completing the series of reports covering back work. The planting investigations now under way in the Region are being carried administratively by the Office of Planting and the Forest Schools. The Regional Office feels that this work is adequate for the present needs, except for a problem of heavy losses of stock through an unexplained disease which has been active for several years at Savenac Nursery. In 1930 there was a loss of nearly one million white pine principally in the 1-0 seedling age class but with substantial amounts in the older age classes as well.

It is felt that the situation is serious enough to need the service of a plant pathologist at the Nursery for a period to determine its cause and formulate remedial treatment.

Nursery Practice

The usual amount of work on amount of seed to sow, fertilizing, and study of broadcast versus drill sowing was carried through the 1930 season. There is nothing new to report on this work.

Dean Spaulding, however, reporting on experiments in nursery practice conducted at the University of Montana School of Forestry states that as a result of these experiments it is now possible to produce plantable stock for several hardwood species commonly used in farm windbreaks in one year instead of two as formerly required.

Sowing and Planting

Dr. Hubert reported that as a result of a study conducted by the University of Idaho School of Forestry it is now possible to point out for southern Idaho the beneficial results of windbreaks on the yield of field and orchard crops, a hitherto disputed point in some sections. A report on this study is now being prepared for publication. Two other planting studies underway at Idaho, one dealing with planting in

alkali soils and the other with planting at high elevations, need to run several years longer before definite conclusions can be drawn. Preliminary results, however, show the beneficial effects of a sand back-fill in planting trees on alkali soils, and the much better survival of hardwoods as compared with conifers on both alkali soils and at higher elevations.

A new project in this general field, a spacing study in western yellow pine using 6x6, 8x8 and 10x10 foot spacing in contiguous plots on identical site conditions, was started during the past year by the Office of Planting. A plot with 15x15 foot spacing is to be added, as well as a similar set of plots of western white pine, as soon as a suitable site is found. This experiment is the direct result of the desire of the Investigative Council, as described in the 1929 report, to have established planting plots with various spacing to check the suitability of the 8x8 spacing now extensively employed in the region.

The study of survival of planting stock on grassy bottom lands continued inactive.

Seed Studies

Mr. Olson reported that being forewarned of the excellent seed crop last fall it was possible to gather valuable data on cone collection and seed extraction for all of the important species of the region. It has been found

that white pine cones collected before August 15 do not open when dry and that cones of other species gathered before this date open slowly and only partially when dry. In addition cutting tests and the weights of the sample indicate that the seeds of early collection are mostly hollow. All cones seem to be in best condition for collection and extraction the first week in September. Germination tests are now being run to give supplementary and more accurate data on some of these points.

Tests are also being made to determine the germinative capacity of western yellow and western white pine seed from various age classes, particularly from very young stands. Regional Forester Kelley pointed out the importance of this work in determining the role played by young trees in reproducing burns. Many 1910 burns, for example, bear a scattered stand of young trees which came in immediately after the fire. These trees are now beginning to bear cones and if the seed is fertile will aid materially in hastening the restocking of such areas. Apparently good cones have been found on 16-year-old yellow pine, 18-year-old cedar, 10-year-old white pine and 19-year-old spruce. White pines usually bear only three or four cones the first crop but the yield increases rapidly up to an age of 45 years. After that the yield is only slightly more and the cones are all borne at the top of

the crown even if the trees are open grown. There is a striking difference between the yield of the western white and western yellow pines. Two pounds of seed is a heavy yield from a mature white pine tree while in exceptional cases mature yellow pines may bear as much as 60 pounds of seed.

A new study of local climatic races of Englemann spruce promises to be both interesting and profitable. In the nursery spruce often suffers severely from frost injury, so much so as to retard new growth and necessitate keeping the injured 75 per cent of the spruce seedlings in the nursery a year or two longer than the uninjured plants. Frost injury in spruce plantations is also common. Accordingly a study is being made of the relative frost hardiness of spruce from various elevations and localities. Seed has been collected from elevations ranging from 3000 to 7000 feet and on both sides of the Continental Divide. The stock grown from each lot will be followed in both the nursery and the field and an attempt made to select local climatic races that will give a minimum of frost injury under both nursery and field conditions.

Forest Influences

No projects are listed in this general field for the northern Rocky Mountain region. But undoubtedly a number of studies now underway, for example the measurement of a

number of climatic factors under full timbered, half timbered and clear cut areas, part of one of the fire studies, will undoubtedly contribute to our knowledge of forest influences. No work is proposed in this field.

Forest Management

There are seven continuing projects in this field, of which three yielded tangible results in 1930.

Methods of Cutting

One of the major projects deals with the determination of suitable methods of cutting in the western white pine type to secure satisfactory reproduction of the desired species and the best development of residual stands. As previously reported the field work on one phase of this study, a transect study of old cuttings, has been finished. Complete results from this work are not yet available and must await careful analysis of the records of individual cuttings. Some preliminary results of a general character are given in Figures I to IV, inclusive. Figure I shows how undisposed slash acts as a mechanical barrier to reproduction. Figure II shows that the most abundant white pine reproduction occurs on the average under light shade but that the amount holds up surprisingly well under even fairly heavy shade. Figures III and IV indicate, respectively, the influence of situation and aspect on

Figure I

Effect of Undisposed Slash
on
Abundance of White Pine

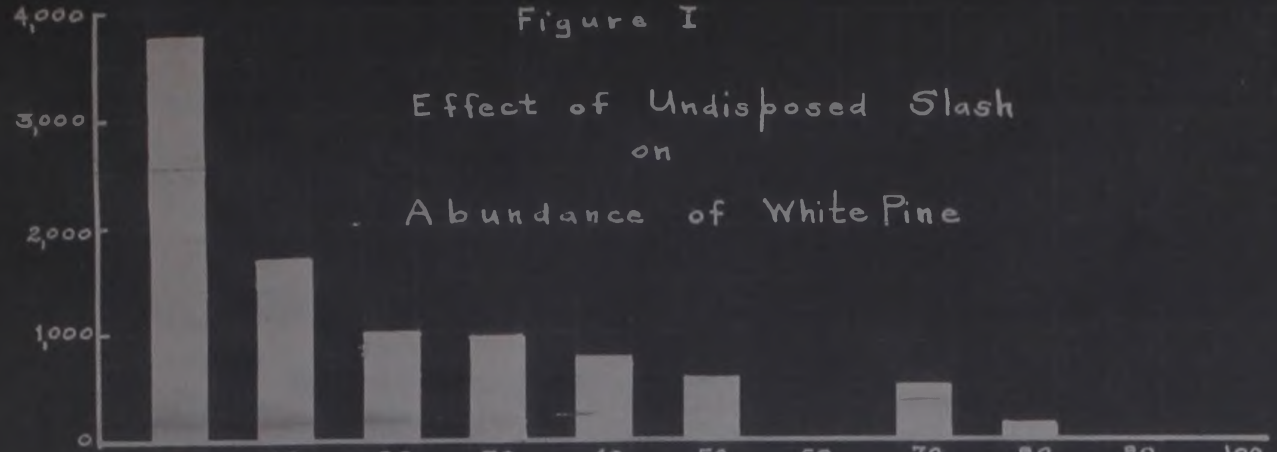


Figure II

Effect of Crown Density
on
Abundance of White Pine

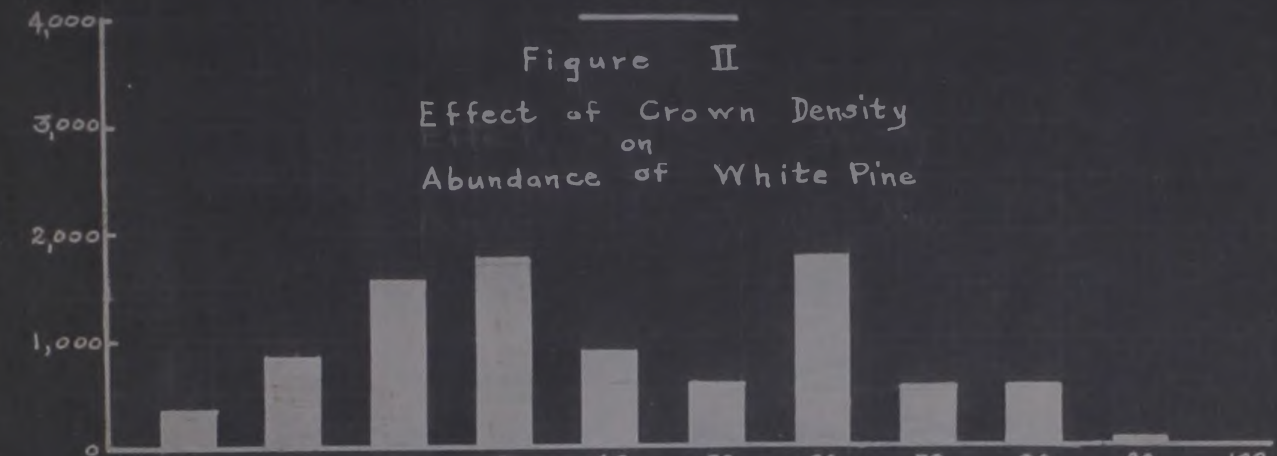


Figure III

Effect of Situation
on
Abundance of White Pine

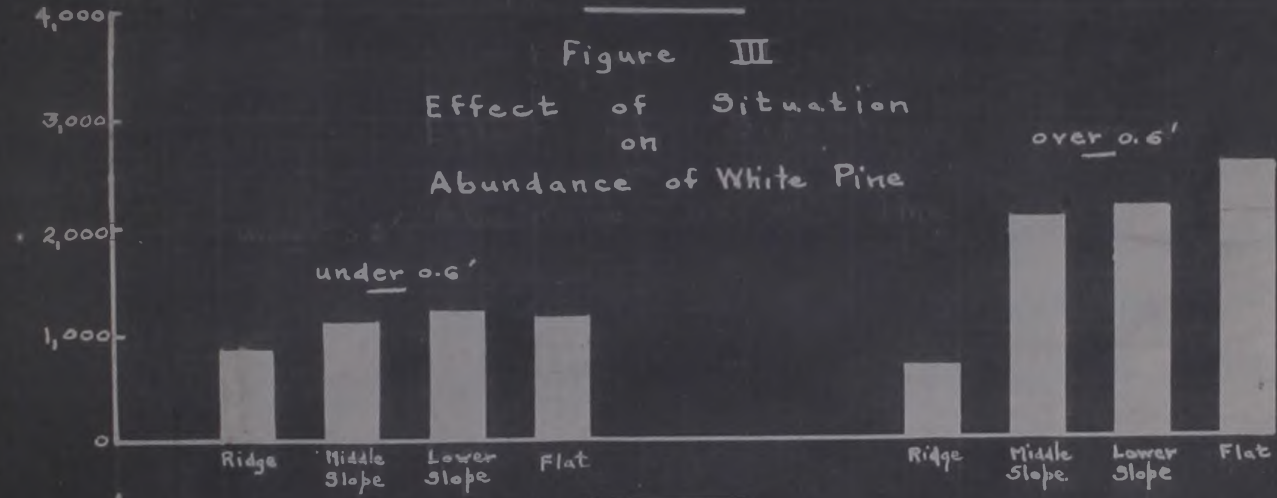
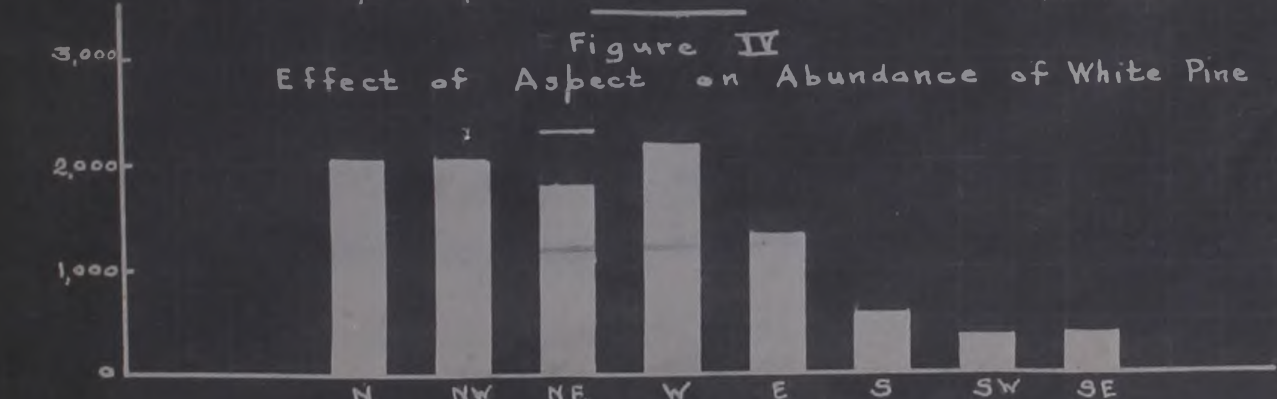


Figure IV

Effect of Aspect on Abundance of White Pine



Number of Seedlings per Acre

abundance of reproduction. As would be expected, the dry ridges and southerly aspects retain the smallest amounts of white pine. These charts present only crude uncurved data, and no attempt has been made as yet to investigate some of the seeming inconsistencies.

Some interesting preliminary results on the growth of residual trees are also available from the transect study. In the Annual Investigative Report for 1929 Mr. Koch described in some detail the need for more information on the rate of growth after cutting on mixed species and white pine in those stands which are not cut clean. The transect study will supply a good deal of information of this sort. Preliminary figures now available show, for example, that the average white pine left after logging grows at the rate of about one inch per decade. This statement is based on increment borings from 1102 trees taken on 158 sample plots scattered over twenty cut-over areas in various parts of the region. This growth is only about one-third to one-half again as fast as on similar trees before cutting so that compared with some other pines, such as western yellow, white pine does not accelerate particularly well after release. About 80 per cent of the white pines left do accelerate to some extent. Rate of growth as well as degree of acceleration vary markedly with a number of factors such as locality, degree of liberation and crown health.

Variation in growth with locality is shown in the following table:

Location	Average Diameter Growth After Logging Inches	Basis. Number of Trees
Pend Oreille	0.7	264
Coeur d'Alene	0.9	394
Kaniksu	1.1	60
St. Joe-Palouse	1.5	384

The Kaniksu and Pend Oreille figures are not entirely dependable due to localizing of data, but between the soil and climatic variations of the northern part of the type and the southern part represented by the St. Joe-Palous section there is undoubtedly a distinct difference in rate of growth.

Liberation or degree of release is also an important factor. Trees with excellent liberation grow on the average about twice as fast as trees with poor liberation. Crown health, however, is the most important factor of all. The growth of trees with good crowns is usually two to three times that of trees with poor crowns. On the Coeur d'Alene the average white pine with a good crown will make about 1.1 inch per decade. The average white pine with the poor crown will make only 0.6 inch per decade. If the tree with a good crown holds its advantage for two decades it will contain at the end of that time between 65 and 125 board feet more than its rival. Crown health usually outweighs other factors., The average residual white fir with a good crown on the St. Joe-Palouse areas will grow about 1.8 inches

per decade with excellent liberation and 1.4 inches with poor liberation. Trees with poor crowns but excellent liberation make only 1.0 inch per decade. It obviously pays to leave trees with good crowns, even if poorly liberated, in preference to trees with poor crowns even with excellent liberation.

These findings have direct practical value. They indicate clearly that it is worth taking the time to select the trees to leave. Other things being equal, the tree with a regular, well-filled crown of normal green color is a good tree to leave; the tree with a straggly crown of sickly needles is obviously a tree to cut.

This study also furnishes some preliminary information on the loss of residual trees through death and windfall. A study of conditions on some twenty timber sale areas, containing a total of 1152 residual white pines on the sample areas measured, shows that on the average about one out of five of the smaller trees (under 14 inches) and one out of six of the larger trees of seed tree size (over 14") dies or blows down in the first 15 years following logging. Most of this loss seems to be due to death rather than windfall, though the nature of the transect study makes it impossible to separate these factors with accuracy. While nothing is known about further loss after the first 15-year period, it is generally conceded that most of the

loss comes immediately after logging, and that the loss after the first 15 years will be small.

The preliminary results given are indicative of what will be obtained in a comprehensive analysis of the transect study material. It is hoped to complete this analysis during the coming year.

The Experiment Station now has a total of twenty permanent plots being used in the methods of cutting study. Most of these are just approaching five years old and are therefore still too young to warrant a thorough-going analysis of reproduction records. Preliminary compilations, however, indicate that most of our timber sale cuttings are reproducing satisfactorily, but the data do not yet give concrete evidence as to why this reproduction is more satisfactory on some areas than on others. The plot records do emphasize, however, that silvicultural problems vary considerably by locality and age class and that conclusions drawn from experiments in one locality or age class may not be applicable in another. To illustrate briefly, the amounts of reproduction from seed shed by seed trees is relatively light on the Kaniksu and relatively heavy on the Coeur d'Alene, the reason, tentatively being a much greater destruction of seed by weevil and squirrels on the Kaniksu. Two investigators working independently in these two localities might quite readily draw different conclusions as to the value of seed trees. Each would be correct in his own locality but

wrong for the other locality. Conditions differ by age class in similar manner and there is no doubt that to correctly solve regional problems our present series of permanent plots is very important and must be greatly expanded. At present the funds available for management studies are barely sufficient to carry the routine examinations of the plots now in existence.

Methods of Reproduction

The Experiment Station project under this head includes both temporary and permanent plot experiments aimed at solving the problems of seed production, distribution and germination, and seedling survival on burns and logged areas. These experiments are now beginning to yield interesting evidence on some of these points, particularly as to source of seed. This has always proved an interesting and difficult problem. It was thought by the first investigators and observers in the region that long distance seeding played the major role in reproducing western white pine forests, particularly in regenerating large single burns. Later, stored seed was regarded as the main source of supply. The permanent plots now being examined indicate the relative importance of two other somewhat neglected sources, namely, current or coincident seeding, as from cone bearing trees killed by the fire but shedding seed on the

ashes, and subsequent seeding, as from seed trees or trees on burns which escaped immediate death by fire even though these trees may succumb some years later to fire injuries and insect attack.

Perhaps the outstanding fact among these preliminary findings is the variety of sources from which the seed comes and the manner in which one source may be dominant in one case, merely contributory in another, entirely subordinate or completely lacking in a third. For example, current seeding, i.e., seed shed from cone bearing trees killed by the fire, had been the dominant factor in reproducing the 1926 burn. But this source would, of course, be totally lacking on areas burnt over in years without a seed crop. Then stored seed has undoubtedly played a part in regenerating some of the cut-over areas being studied, and subsequent seeding has also played a part, sometimes a dominant part, in the reproduction of still other areas. In general, stored seed seems to play a less important role, and current and subsequent seeding a more important role, than heretofore supposed. One interesting fact brought out by the permanent plots is that reproduction from stored seed will all come up within the two years following logging. Any reproduction coming in after that time is assuredly from some other source.

Two of the permanent experiments on the program give additional interesting information on the source of seed problem. First, experiments in which seed has been stored naturally in the duff, which are now in their third year, indicate that white pine seed is the only kind of seed (with the possible exception of lowland white fir) to remain viable to any extent after one year's storage in the duff under natural conditions. This is shown in the following table:

Percentage of Viable Seed After Natural Storage Under Virgin Timber

Period of Storage - Years	Western White Pine		Other Species				
	Larsen's Tests '21 to '25	Knoll Plot Tests '27 to '29	Knoll Plot Tests '27 to '29				
			Eng. Spruce	Doug. Fir	Cedar	White Fir	Larch
0	No record	41.3	38.2	21	15.3	No record	No record
1	20	42.2	0.6	0.1	0.0	"	0.5
2	1	10.0	0.1	0.0	0.0	0.0	0.0
3	33						
4	0						
5	0						

Second, an experiment in fire girdling western white pines shows that cone bearing trees killed at the ground by fire will produce viable seed by the time the cones open in the fall.

Percentage of Viable Seed

Trees Fire-killed		Normal Trees (Check)
June, 1929	July, 1929	
30.7%	37.4%	54.2%

The normal trees, however, seem to produce a greater amount of viable seed and apparently the later in the season a tree is fire killed the better chance it has of producing a normal crop. But cone bearing western white pine trees killed even as early as June will mature considerable amounts of seed.

Some preliminary figures are also available on seedling survival. This information is given in the following tables:

Percentage of 1927 Western White Pine Seedlings Dead by Years

Year	Percentage Dead	Character of Season
1927	13	Moist
1928	22	Dry
1929	9	Extremely dry
1930	5	Very dry

Percentage of 1927 Seedlings Surviving in Fall, 1930

Species	Per Cent
L. W. Fir	71
D. Fir	63
W. Larch	56
W. W. Pine	51
W. Hemlock	27
W. R. Cedar	24

These figures are only tentative and will undoubtedly be changed somewhat by the inclusion of more data. It is clear, however, that most seedling deaths will come in the first two years after germination and that from the third year on death from normal causes, other than competition, will be negligible. It also seems safe to say that for western white pine one out of two or, conservatively, one out of three seedlings will survive at least the early seedling stages and that any white pine seedling a foot or over in height may be safely considered as established for it is quite sure to be over three years of age. Information on this point has been heretofore completely lacking.

Brush Disposal

The only active project in this important field is conducted by the University of Idaho. The study has evolved along two lines. First, the development of a torch or burner capable of igniting one to two year old slash independent of weather conditions, thus eliminating the necessity of burning slash when it is not perfectly safe to do so. This work has now progressed to the point where the Hauck Manufacturing Company is ready to build a burner incorporating all of the principles evolved and to place it on the market as a modification of the Standard burner. Excessive carbonation is the last obstacle to be overcome.

The other phase of the problem has involved a study of slash disposal in overmature western white pine stands containing a great deal of valueless and decadent mixed species. A method of restricted slash burning has been developed in which the worthless residual trees are felled and disposed of along with the logging debris in such a manner as to conserve whatever seed trees may have been retained. This method is roughly about one-third as expensive as piling and burning.

Thinning

No progress except the periodic remeasurement of two plots in 1930.

Mensuration

Very little progress was made in this field during the past year. As stated in the 1929 report the western white pine yield study conducted by the Experiment Station has produced complete yield, stand and volume tables for second growth western white pine. The manuscript presenting these tables and accompanying text will be submitted for publication by summer. No progress has been made on the application study which should follow, and there is no prospect of this work being undertaken until an increase of Station funds for silvicultural research permits the assignment of a staff man to this job.

Seven permanent yield plots, four white pine, two Douglas fir and one red cedar plot, and twenty-three semi-permanent yield plots in white pine stands, were given their

first five-year remeasurement in 1930. The semi-permanent plots, of which there are 58 in all, are an interesting and promising innovation in our permanent plot system. They were first installed as temporary plots in 1925 and 1926 in the course of the normal yield study. The boundary of each plot was carefully blazed and one corner post set and tied in to some convenient land mark. Individual trees are not tagged as on permanent plots. But as such plots are inexpensive to install and easy to remeasure, they should prove of considerable value in supplanting our skeleton series of standard permanent plots on which trees are tagged and measurements taken and kept in detail for individual trees.

The remaining projects in this field of which the Experiment Station carries six, the Office of Management and the University of Idaho three each, and the University of Montana two, are for the most part either inactive or continuing projects requiring only incidental or periodic attention. Mr. White's transfer to other work has made it impossible to do very much investigative work during 1930 on the Office of Management projects. The Experiment Station may be asked to compile some of the data taken in the increment studies of that office.

One very interesting project, however, was undertaken jointly by the Office of Products and the Office of Management. This was an increment study of a second cut operation conducted by the lumber department of the Anaconda Copper Mining Company.

The operation involved relogging over a thousand acres of western yellow pine timberland in the vicinity of Greenough, Montana, originally cut over lightly some 40 years ago by the Big Blackfoot Milling Company. A cut of from four to six thousand board feet per acre was realized. In numerous places the old stumps and tops were sufficiently well preserved to permit accurate measurement of stand conditions in 1888, the time of the original cutting. In 1888 numerous trees 14 inches and under in size were left in addition to limby or otherwise undesirable trees of larger size. In 1927, the date of re-logging, any 12-inch tree that would make one straight and smooth log with a 6-inch top was cut. An understory stand of second growth was left after this operation, including some dominant young trees as large as six to eleven inches in diameter.

The data recorded will yield information on the amount and character of material logged at each date, the increment by tree sizes and a comparison of utilization practices in 1888 versus 1927. The economics of carrying this land from 1888 to the present time will also be analyzed and a prediction made of the future growth on this area in the next forty years.

The analyses to date disclose some interesting changes in utilization practices in the last forty years. Merchantable lengths and top utilization diameters in the old days reflect with emphasis the "high grading" practices prevailing at that time. The following tabulation shows a comparison of these variables by tree diameters for western yellow pine:

D.B.H. Ins.	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38
Merchantable Tree Length Feet															
1888	-	24	30	34	36	38	38	40	40	42	42	42	44	44	44
1927	30	38	46	50	46	60	62	66	68	70	72	72	74	74	76
Dif.	-	14	16	16	20	22	24	26	28	28	30	30	30	30	32
Top Diam. Av.Tree, Ins.															
1888	-	7.1	8.9	10.9	12.6	13.8	15.0	16.0	17.0	18.2	19.5	21.1	22.7	24.6	26.9
1927	5.5	6.6	7.3	7.8	8.3	8.8	9.4	10.0	10.6	11.6	12.8	14.2	15.8	17.8	20.1
Dif.	-	.5	1.6	3.1	4.3	5.0	5.6	6.0	6.4	6.6	6.7	6.9	6.9	6.8	6.8

The presentation of this project at the Council Meeting was followed by a lively discussion, which clearly emphasized the interest and importance of studies of this sort and the desirability of more work of this character. The Council discussed at some length the possibility of carrying on growth studies with administrative forest officers particularly during the winter when other work is less pressing. Some of the Council felt that winter work of this sort would be too difficult and possibly inaccurate.

But the general feeling of the Council seemed to be that more of it could be done if it were given recognized priority particularly in mild and favorable winter weather. It was stated that ten days or so of field work of this sort will provide data for a month or more of office work. The Regional Forester expressed the feeling that this type of work would be excellent for administrative research and well worth the effort necessary to organize it. Several administrative projects are to be proposed for next winter.

Protection

This is by far the largest field of research in the Northern Rocky Mountain Region. About two-thirds of the research funds expended in the region are devoted to research in forest protection against disease, fire and insects.

Diseases (Blister Rust)

Mr. Wyckoff reported that the investigative and experimental work of the Office of Blister Rust Control continued in 1930 along two general lines of investigation (1) development and improvement of Ribes eradication methods, and (2) field studies of the rust.

Continuing field studies on methods of stream type Ribes eradication have resulted in improvements of both apparatus and working methods. Recent laboratory results have shown distinct possibilities in stem injection and crown injection methods of killing Ribes as contrasted with the spraying methods now in use. This opens up new fields of

experimentation on both the Ribes themselves and the method and apparatus for their application. Both chemical investigations and methods experiments are planned to develop these new possibilities. Mr. Offord, who conducts the chemical investigations, explained in detail the interesting and fundamental investigations now under way to develop a suitable toxic chemical by which all Ribes occurring in the white pine belt may be economically and effectually eradicated. Such a chemical and its method of application must be non-hazardous within the limits of field work. Experiments made in 1929 proved conclusively the toxicity of simple chlorate and hygroscopic chlorates to R. petiolore. But R. inerme and R. lacustre continued to exhibit the previously reported high degree of tolerance toward all chemicals tested as sprays. Laboratory investigations of differences in physiology and morphology among these species suggested the following chemicals and methods of eradication for resistant Ribes, (1) the use of buffered chlorate solutions applied as a spray; (2) the use of oils of high penetrability as a carrier of a solution of a soluble organic toxin, preferably a complex salt of a heavy metal; and (3) the use of a complex salt of a heavy metal injected into holes or incisions in the crown or stem. Preliminary results speak favorably for the use of a copper cyanide-sodium thiosulphate complex when injected into a slit in the stem tissue. This compound gives a good top kill even though injected into only one top stalk. Whether or not it will give a root kill is yet to be determined.

Attention is also being given to the permanent suppression of Ribes in the stream type, the ultimate objective being to permanently replace the stream bottom brush type with a turf or coniferous cover. Thus far only turf establishment has been attempted. Several methods which have been or will be attempted include killing the brush with toxic chemicals, spraying the brush with chemicals or oil followed by burning, and cutting, piling and burning the brush. All of these are to be followed by sowing to clover, timothy and other grasses in the following spring. Experiments will also be made in which the brush is cleared, piled and burned and the soil plowed up preparatory to sowing grass or hay, with the use of heavy road machinery. The possibility of using sheep or goats to prevent brush encroachment was also suggested.

The probability that stream type Ribes eradication will be completed in certain areas within the next year, and that the rust will be rapidly intensified in the white pine belt in the next few years, makes it necessary to turn again to large scale experiments upon methods of upland type Ribes eradication during 1931. New work is also being started on permanent plots which will definitely inform us as to the degree of infection and consequent damage to be expected from given amounts of Ribes. By this means we shall secure a measuring stick with which to determine the degree of efficiency which Ribes eradication must attain in order to actually control the rust.

Dr. Schenck mentioned several blister rust resistant pines. At the request of the Experiment Station, seed of one of these, Pinus peuce, was secured several years ago and planting stock is now being grown at Savenac Nursery and some will be planted in blister rust infected areas to test its resistance under local conditions. Experimental planting plots of this species are to be established by the Experiment Station and the Office of Planting to determine growth, yield and adaptability to this region. The possibility of finding a blister rust resistant race of P. monticola was also discussed.

Dr. Hubert described the germination studies of Ribes seed now being carried on cooperatively by the University of Idaho and the Office of Blister Rust Control. Tests of 10,000 seeds of five species of Ribes were made in 1929-1930. The alternation of temperatures from 20 to 50 degrees Centigrade and from 25 to 50 degrees Centigrade were found most effective in stimulating germination. The neutral plot was found more favorable than the acid plot in this respect.

Disease (Rot producing)

One cooperative project carried by the University of Idaho and the Forest Service, dealing with the cull rot in standing timber, and three projects on the decay and sap stains of native woods carried by the University of Idaho, are the only studies now under way in this large and important field. It was the opinion of the Council that, regrettable as this is, the situation cannot be remedied without the allotment of funds badly needed in other fields or without an increase in funds directly appropriated for such studies.

The study of cull rot in standing timber was inactive during 1930 for lack of funds. Progress reports covering this work have been issued. Further work on these studies are urgently needed in view of the future crops of secondary species which may develop on white pine lands where the white pine timber present does not warrant protection from the blister rust. But no funds are available for this work.

A number of reports on various phases of the other three projects conducted by the University of Idaho have already been published. All of these projects are continuing and investigations on new phases are now underway. One of the interesting features on this work has been the isolation of fungi causing brown rots and sap stains in lumber and other wood products. More than 17 different fungi were isolated as causing different types of blue stain alone. Contrary to

accepted belief laboratory tests show that the presence of blue stain in the sapwood of western white and western yellow pine does not reduce the resistance of these woods to decay. Controlled tests using clear, medium and heavily stained test sticks showed an average loss in weight of 14.8 per cent for the heavily blued and 15.1 per cent for the clear unstained wood.

Fire

During the past year an important change has been made in the character of the Experiment Station effort devoted to fire research. The three projects previously carried have been continued but on a diminished scale, and about one-third of the fire research effort has been devoted to a new project. This new work involves the statistical analysis of the Region I fire records to determine the speed and strength of attack necessary to attain successful fire control in each important timber and fuel type for the Region. The work is planned along the lines developed by Show and Kotok in California. Data on the speed and strength of attack needed to produce satisfactory protection are fundamental to adequate fire control and essential in any comparison of the financial needs of one Region with those of another. This was brought out very clearly at the 1930 Washington Conference of Regional Foresters. Data of this sort will also be invaluable in the transportation and

organization study now being conducted by the Regional Office to provide plans for the proper distribution and abundance of roads, trails and men.

In addition to this new work the three projects reported regularly in the past were carried forward successfully. The work devoted to weather and fuel relationships was greatly improved by the addition of considerable physical equipment and the installation of three new stations at Priest River for measuring the fuels and weather elements on representative clear-cut, half-timbered, and full-timbered areas. All three stations are now located within a short distance of each other on a large flat with entirely comparable conditions except for the density of forest cover.

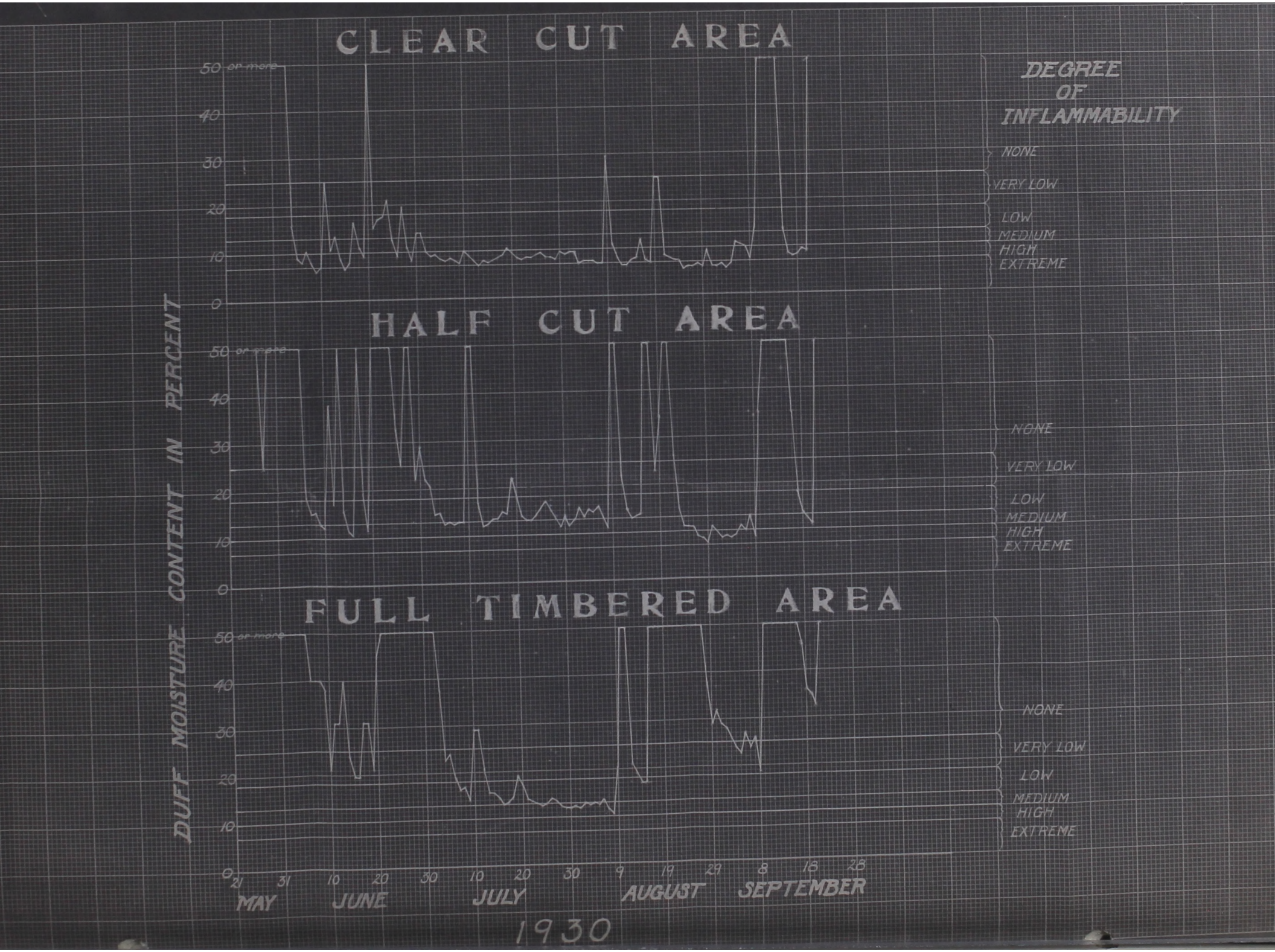
Recording duff and air thermographs are among the newly added equipment on each site and the past season's records made by these instruments give some remarkable information on the great importance of shade in holding down surface temperatures, and hence in maintaining higher fuel moisture contents. These instruments recorded on some days, for example, many hours of surface temperatures of over 130°F. on the clear-cut area while the maximum under half shade reached only 100° to 110°F., and under full timber only about 87°F., the latter often lower than the temperature of the air in the same locality. As evaporation

of moisture from fuels is more than twice as rapid at 130° as at 100°, the shade of remaining trees on a logged-over area is obviously of great importance in reducing fire danger. Furthermore, the higher temperatures found on the clear-cut area, i.e., sustained temperatures of over 130°F., are recognized as dangerous to both ungerminated seed and seedlings. Data on the influence of shade on surface temperatures, therefore, is valuable to both fire and silvical studies alike. The chart shows the variation in inflammability at these three stations during 1930.

The work on the study of lightning and forest fires continued without much change, the Regional Office helping materially as usual by contributing a qualified ranger to code the 1930 reports. A report covering this work from 1924 to 1928, inclusive, has been submitted for publication.

In the cooperative fire weather project the Forest Service continued, as during the previous year, to report daily measurements to the Spokane Office of the Weather Bureau. Beyond a doubt, this work has aided materially in improving the accuracy of the local forecasts.

The increase in fire research funds to become effective July 1, 1931, will permit desirable expansion in a number of fields. The exact details of expansion have not yet been worked out but one man will probably be assigned to a fire damage study, one to carrying the fire studies now underway, and one to the new statistical study previously described. This arrangement


CLEAR CUT AREA
HALF CUT AREA
FULL TIMBERED AREA
DUFF MOISTURE CONTENT IN PERCENT
50 or more
40
30
20
10
0
DEGREE OF INFLAMMABILITY
NONE
VERY LOW
LOW
MEDIUM
HIGH
EXTREME
21 31 10 20 30 10 20 30 9 19 29 8 18 28
MAY JUNE JULY AUGUST SEPTEMBER
1930

will permit one man to compile and analyze the five-year records now available in the weather and fuel relationship study, a very desirable piece of work. And the assignment of one full-time man to the statistical study will enable desirable progress on this work with possible expansion at some later date to an analysis of State and Association records if such procedure seems desirable.

Among the research projects carried by the Regional Office of Operation the development of portable radio telephones for field use continues to be the study of major importance. The purpose is to build readily portable radio sending and receiving sets that can be used to supplement, and in some cases take the place of, the grounded line telephone system now in use on the National Forests and to find and develop radio directing apparatus that can be used by men searching for obscure fires. Both portable and central station instruments have been developed which give encouraging but not entirely satisfactory results under field conditions. Further work during the coming year will be directed toward improvement of performance of the central radiophone station, further elimination of interference noises, and solution of problems relating to the volume of traffic the system will handle. Forest Inspector, D. L. Beatty, will continue to devote full time to the project during the coming year with such contributed help as may seem desirable. The Council displayed a great deal

of interest in this project and felt that Mr. Beatty should be invited to the next Council meeting to discuss it in person.

The Office of Operation carries five other projects, one on aerial mapping, one on adequate fire control from an economic standpoint, two on tests and improvement of equipment and one minor project on the relation of lightning fires to underlying geological formations. These are all continuing projects and no definite results are ready for discussion at this time.

The Council displayed marked interest in the discussion of possibilities of using heavy machinery in fire control. The Roto-Tiller was mentioned as being used satisfactorily in Region 6. Dean Spaulding reported that a heavy tractor and Russell grader with a 5 to 8-man crew were found capable, under suitable conditions, of building more line than a 50-man crew working by hand methods. Jacobson reported that the Killifer plow has been used successfully in the Bend territory. Spaulding and Jacobson agreed that when machine equipment is usable it is possible to average about one and one-half miles of line per hour. The Regional study of the use of tractors in fire line construction is to continue.

The Council felt that the study of lightning storms in relation to geologic formations should also be carried to completion since only a very small sum will do this satisfactorily.

The Operation study of adequate fire control will probably be absorbed by the new studies to be initiated under the expanded Experiment Station program. The project of aerial mapping was also discussed, and the Council felt that Mr. Yule should be invited to the next meeting to discuss the map making features in more detail. The development of the multiple lens camera has reduced the difficulties in this field very materially and air mapping seems to have remarkable possibilities. Mr. Melrose reported that the Ontario and Dominion Forest Services have successfully completed very large amounts of aerial mapping.

The Spokane Office of the Weather Bureau continued its studies on lightning storms and fire weather. A seasonal summary of weather conditions during 1930 from a fire weather standpoint has already been completed. A special study was also made of the weather conditions during August, 1929, particularly of individual days when going fires made the greatest headway. A preliminary report on the Weather Bureau lightning study will probably be available in June, 1931. It may be stated that the Weather Bureau fire research program in this region is still somewhat cramped for lack of funds.

Insects

Serious destruction of merchantable timber by bark beetles of the genus Dendroctonus constitutes the most serious entomological problem confronting the Council at this time. As a

result practically the entire investigative force of the Coeur d'Alene Forest Insect Field Station has been concentrated upon the development of more efficient control measures and the improvement of those now in use. In the prosecution of the study it has been necessary to consider such phases as the seasonal history of the insect responsible for the destruction, its relation to the parasitic and predacious insects found in association with it, the role of insectivorous birds, the relation of climatic conditions to insect development, the reaction of the insect to certain external stimuli, the physiological and chemical properties of the host, in fact, a complete study of the insect in relation to environmental factors.

As a tree once successfully attacked by bark beetles cannot be saved, control measures are directed toward the destruction of the insect broods within the infested trees in order to prevent their emergence and subsequent attack of other trees. In attempting to improve the direct control measures now in practice the possibilities of destroying the insect broods through the creation of abnormal subcortical conditions, solar heat, traps, poisoning, etc., were all thoroughly tested in both lodgepole and white pine stands. Poisoning methods were given a rather thorough test in 1930. A fairly rapid and inexpensive method of cutting a shallow saw kerf through the bark and then tacking a flared, tin, cup-like collar around the tree below the cut, to hold the

poisonous solution, was developed. But although this method worked very satisfactorily as far as applying the solution was concerned it was found that the tree would not absorb the liquid uniformly. A short distance above the saw kerf the absorption was very irregular, usually following a strip up one side of the bole in a manner difficult to explain. Though the insects were destroyed wherever the poison was absorbed further study is necessary in order to bring about a uniform assimilation of the solution before the method can be used effectively as a control measure. Some further work along this line is planned for the season of 1931.

The development of more efficient control methods in the white pine type is particularly important as the cost per tree, varying from $3.50 to $6.50 is considerably higher than in lodgepole. The method of spring control now in use for infested white pines is to fell the tree and remove the bark from the infested portion. It was found that following this operation the insects were rapidly destroyed by ants, mice, squirrels, shrews, etc., making this method very successful. Many of the nearly formed adults, possessing powers of locomotion are able to protect themselves by crawling down into the debris for concealment and these are able, in spite of abnormal conditions, to complete their development, attack and produce fertile eggs.

Successful progress has been made in the study of parasitic insects. The objective of this study was the correlation of artificial control measures with the seasonal histories of the most beneficial insects in order to take advantage of these natural agencies of control in combatting future epidemics. Two primarily important insects have been found, a Coeloides sp. (Hymenoptera) and a Dipterous (Mediterus aldrichi), both of which are very destructive to the larval stages of the mountain pine beetle. Though these insects are found in both white pine and lodgepole pine, their seasonal histories are quite different. On lodgepole pine these parasitic insects attack the overwintering brood of the mountain pine beetle late in May and June, so that the adoption of fall control is advantageous as it protects these beneficial insects. But in white pine these parasites attack both the overwintering and summer broods making fall control of very little, if any, advantage. Though this study has been fairly well completed there are several important phases requiring additional study.

The biology of the mountain pine beetle was rather intensively studied during the past season. A point of unusual interest is the emergence of parent adults in five or six weeks following the first attack, and the re-attack of another tree. This may or may not prove to be a normal condition and its economic importance is yet to be determined.

All control projects for the suppression of barkbeetle have been and still are regarded in the light of experiments

with the idea of improving the methods in present use. Valuable information relative to the potential of flights, multiplication, etc., as well as in the administration and supervision of control work, has resulted from these studies. It is very clear that more emphasis must be given to the quality of the work performed. The need for more trained and exacting supervision is very evident. The 1930 survey on the Beaverhead shows an increase of 60 per cent over the 1929 attack which means that, in spite of the expected marked reduction in the percentage of increase, the devastating epidemic is continuing with an increase in its severity.

During the past season an intensive spraying operation was instituted against the spruce budworm in the Cody Canyon to determine if the lead arsenate spray, successfully used against the Gypsy moth in the eastern United States, would be effective in the control of this insect. Though some success was attained the work cannot be considered as satisfactory. This is due to the peculiar feeding habit of the insect in attacking the base of the new needle. It is difficult to reach this portion of the foliage with sufficient poison to be fatal. Furthermore, considerable difficulty was experienced in securing a good coverage upon the new growth which does not seem to possess the adherent qualities of the old needles. As a result of this work it is evident that the spruce budworm will prove to be an insect difficult to control with standardized

spraying methods. The problem demands thorough fundamental study.

Mr. Melrose described some experiments in airplane dusting for spruce budworm which are apparently getting good results.

Additional field and laboratory work have been conducted on the parasites and predators of the fir tussock moth. These parasites have been so active during the past season that the epidemics in Nevada, Central Idaho and northeastern Washington have been very materially reduced. A new predator (Calosoma sycophanta) has been liberated at Northport, Washington, in the hope that a colony of these very beneficial insects can be established.

Satisfactory progress has also been made on two minor projects conducted by the Forest Insect Station, one dealing with the inter-relation of fires and insects, the other following the defoliation of yellow pine by the severe freeze that occurred in December, 1934. In both cases the insect attack is regarded as secondary.

Two additional projects will be added in 1931, one a study of the Douglas fir beetle (Dendroctonous pseudotsugae) and the other a study of the Oregon pine engraver (Ips oregoni).

Products

There are a total of fifteen projects under this head, five carried by the Regional Office of Forest Products, four by the University of Idaho Forest School and six by the University of Montana Forest School. This list of projects includes studies of logging and milling practices, utilization, woods waste, tie, pole and post preservation, etc. These studies are almost all devoted to solving immediate and practical problems of dollars and cents value to the lumberman, though in certain studies of wood chemistry and moisture content the work is necessarily of a fundamental character.

Logging and Milling

The five projects carried by the Office of Forest Products are each really fields of work involving a number of separate investigations. For example, the logging and milling studies conducted during 1930 include tree to green chain studies in western yellow pine, three of which have now been completed, and a study of depreciation in fire damaged white pine as well as the A. C. M. relogging study described under Mensuration.

The tree to green chain studies have already furnished information of great value and will be published upon as quickly as possible. They show, for example, based on the Pondosa pine values ($23.50 per M) for the first half of 1930 and production costs as of 1929, that a 20-inch western

yellow pine cannot be handled with any return for stumpage, interest or profit. Trees below this size are handled at a loss reaching $8.50 per M for 14-inch trees, and larger trees at a profit reaching $8.20 per M in 36-inch trees with the margin widening fast in trees above this size.

The effects of height on value is shown in the following table:

EFFECT OF HEIGHT ON VALUE

Western Yellow (Pondosa) Pine

D.B.H. of Tree (ins.)	Logs per Tree	Value per M Lbr. Tally	Spread Between Heights	Value per M of Average Tree Each Diam. Class	Spread Between Diam. Classes
14	2	$ 20.76			
14	4	$ 22.28	$1.52	$21.77	→ $ 1.77
16	3	$ 21.50			
16	5	$ 27.63	$6.13	$23.54	→ $ 1.02
20	4	$ 23.82			
20	6	$ 26.79	$2.97	$24.56	→ $ 4.07
24	4	$ 28.08			
24	6	$ 28.81	$0.73	$28.63	→ $ 4.56
30	4	$ 30.82			
30	7	$ 37.64	$7.42	$33.19	→ $ 2.44
33	4	$ 28.72			
33	6	$ 31.76	$5.04	$30.75	

The question of whether top logs of the same dimensions cut from trees of different diameters produce the same amount of quality lumber is another interesting point on which the tree study furnishes information. This study brings out the following facts:

(1) There was an increase in the value per M of the 7" top logs in trees 12" up to 14" in d.b.h., and then a decrease in the value in trees up to 18", the largest tree from which a 7" top log was cut.

(2) Top logs 8" in top diameter increased in value in trees 15" to 18" d.b.h., and then decreased rapidly in value in the 19" to 25", trees.

(3) Top logs 9" in diameter decreased in value in trees 12" to 15" in d.b.h. and then increased rapidly in value in trees up to 25", the largest tree from which they were cut.

(4) Top logs 10" in diameter decreased in value in trees 16" to 19" in d.b.h. and then increased rapidly in value in trees up to 25". No 10" top logs were cut from trees larger than 25" in d.b.h.

(5) Butt logs 12", 14", 15" and 16" in top diameter increase rapidly in value from the smallest tree in which they occur up to the largest tree from which they can be cut.

(6) The taper varies greatly in logs of the same dimensions and position in the tree cut from trees of different diameters. The amount of lumber that can be cut from a log of given size increases rapidly with the taper.

A very interesting comparison of long log versus tree length tractor logging was also made from the tree studies. Since the two methods include practically all of the tractor logging in western Montana this comparison is of considerable

interest to yellow pine operators. Felling, limbing and topping trees plus bucking at the landing and felling, limbing and bucking into long logs in the woods were compared. On a tree-diameter basis the volume output per effective hour is all in favor of the long log system. This is also true from a cost standpoint. For instance, trees 24" d.b.h. can be felled, limbed, and bucked into long logs in the woods for 56 cents per M contrasted to 68 cents per M for felling, limbing, and topping plus bucking at the landing. The difference is 12 cents per M. The volume difference in output for 24" trees is 130 feet per effective hour in favor of the long-log system. The skidding comparison of the two methods shows the long-log system up to a better advantage, but not so decisively as in the previous comparison. It is apparently cheaper to use the tree-length system of skidding for trees from 12" to 18" in size, but above that diameter the long-log system is cheaper. Since the average tree in most of our yellow pine stands is over 18" d.b.h. and the majority of trees moved are over 18" d.b.h. it appears that the long-log system of tractor logging is the more economical.

The results of the study of depreciation in fire damaged white pine have already been presented in THE TIMBERMAN. Two of the outstanding findings in this study were:

1. Green-cut sound (check) logs in this study yielded an average of 7 per cent No. 4 and 5 common lumber. One-year-old fire-killed logs (sound except for fire defect) yielded 11 per cent. Two-year-old fire-killed logs (sound except for fire defect) yielded 24 per cent. Two-year-old fire-killed logs yield more than three times the normal amount of No. 4 and 5 common lumber.

2. Two-year-old fire-damaged logs lost 16 per cent of their lumber-sale value. One-year-old fire-damaged logs lost 10 per cent of their lumber-sale value. These figures are based on average Western Pine Manufacturers' Idaho white pine prices for 1927 minus deductions for normal degrade and shrinkage from green chain to car. Using the same figures as a basis the following tabulation shows the selling-value loss by log runs for one and two-year-old fire-damaged logs.

SELLING VALUE LOSS BY LOG RUNS

Log Class	Number of Logs per Thousand Feet Log Scale												
	4	5	6	7	8	9	10	11	12	13	14	15	16
2-year $ Value	6.30	6.40	6.50	6.65	6.80	6.85	6.95	7.00	7.00	7.05	7.00	6.95	6.90
2 yr. %	15	15	15	15	16	16	16	16	16	16	16	16	16
1-year $ Value	3.70	3.80	3.90	4.05	4.15	4.30	4.45	4.55	4.75	4.90	5.10	5.30	5.50
1 yr. %	9	9	9	9	9	10	10	10	11	11	12	12	12

Further work in the general field of logging and milling studies will involve the compilation of a series of trade journal articles on the three yellow pine tree studies and a similar study in western white pine if the necessary cooperation can be obtained. The Experiment Station is very anxious to cooperate in this work but so far funds have not been available. A tree study in the larch-fir type will be made as soon as time permits.

Utilization and Waste

The Office of Forest Products carries six studies under this head. An article on the chute depreciation study has already been published in THE TIMBERMAN. This study contributed directly to our knowledge of value losses from chute damage. It was found that the volume loss log scale ranged from 4 to 6 per cent depending on the size of timber. The small logs suffered the greatest value loss as well as the greatest volume loss per thousand feet of logs handled. Value losses based on May, 1929, white pine prices are as follows:

	Logs Per M							
	7	8	9	10	11	12	13	14
Value loss Per M	$ 1.24	1.41	1.57	1.72	1.89	2.05	2.21	2.37

The woods waste inventory has been partially compiled and some interesting preliminary information is given below:

WHITE PINE TYPE

WOOD MATERIAL PER ACRE LEFT AFTER LOGGING

Age Class	Feet Board Measure: Volume Logged Per Acre—Gross: W.P.	Total	Volume Left Per Acre—Gross: W.P.	Total	Waste Net: Merch. Saw logs: W.R.	Tot.	Stumps: Ave. Hght. Ins.: % of Stumps Sound White Pine	Def- ective W.P.	Merch. Waste High Stumps	Tot.	Waste: Total Board M.	Total Cubic F.
80-100	20400	27300	1700	4800	500	700	16.4	19.6	340	460	1160	413
101-120	16400	27300	500	5500	400	600	15.3	38.9	240	540	1340	518
141-160	15000	18700	2100	8900	280	440	10.6	36.2	145	230	670	1080
200 +	13500	18800	700	18300	190	620	11.9	50.3	105	225	650	1367
All	17800	25300	1134	10600	400	820	14.5	37.6	215	410	1230	1117

* 8" D.B.H. and larger.
** 30% defective.

Preliminary compilations of existing data in the logbucking for grade study indicates the numerous ways in which this project may make contributions of value to the lumber industry. One interesting fact is that out of tree studies involving a total volume of 500 M to 600 M feet not a single sound yellow pine butt log over 27 inches was found. The following table shows the effect of fire on log values for a few representative diameters:

16" Grade 1 Logs

Taper Inches: 2" Value Per Sound Log	2" Fire Dam.	2" Loss Per Log	4" Value Per Sound Log	4" Fire Dam.	4" Loss Per Log	5" Value Per Sound Log	5" Fire Dam.	5" Loss Per Log	8" Value Per Sound Log	8" Fire Dam.	8" Loss Per Log
$ 5.89	3.71	2.18	6.51	4.67	1.84	7.72	7.20	.52	6.43	3.90	2.53

18" Grade 1 Logs.

4" Value Per Sound Log	4" Fire Dam.	4" Loss Per Log	5" Value Per Sound Log	5" Fire Dam.	5" Loss Per Log
$11.01	9.12	1.89	11.18	8.35	2.83

20" Grade 1 Logs

3" Value Per Sound Log	3" Fire Dam.	3" Loss Per Log	4" Value Per Sound Log	4" Fire Dam.	4" Loss Per Log	5" Value Per Sound Log	5" Fire Dam.	5" Loss Per Log
$12.58	7.19	5.39	16.50	11.93	4.57	16.38	11.68	4.70

24" Grade 1 Logs

4" Value Per Sound Log	4" Fire Dam.	4" Loss Per Log	8" Value Per Sound Log	8" Fire Dam.	8" Loss Per Log
$26.32	10.53	15.79	19.32	8.15	11.17

The priority given to the deppeciation study of fire-killed white pine prevented compilation of data in the breakage in felling study. A new study in the utilization of small tie sawmills has not yet progressed to a point where any definite results may be stated. No work was done on the depreciation of bug-killed white pine as the Holstead Mill near Troy, Montana, did not operate and no other suitable location could be found.

The University of Idaho carries one project on utilization and wood waste. The object of this work is to develop new and better uses for woods and wood products native to Idaho, including a study of chemical derivatives from wood, wood waste, slash and other parts of the tree. Six articles, each covering a different phase of this work, have already been published. One of the most interesting phases involves a study of the fungi which produce chemical by-products of commercial value. Another brief study dealt with the thermal conductivity of compressed Douglas fir, in the course of which a simple method was developed of binding ground bark into solid cylinders. Using this lead, the Clearwater Timber Company worked out a method of heating and pressing fine shavings into briquets which burn without ash and without clinkers. These briquets now sell in Lewiston, Idaho, at $10 per ton, and local orders are taking the entire present output of the Company's mill.

Preservation

The regional wood preserving studies being carried on in cooperation with the Forest Products Laboratory include a number of experimental tests to determine the durability of treated and untreated woods in actual service and the efficienty of different preservatives when applied by different methods. These tests include treatments with creosote, creosote-petroleum mixtures, zinc chloride, sodium fluoride and various forms of Anaconda Wood Preservative. Information resulting from actual experience in treating various kinds of wood growing in this region has been used as the basis for present specifications for the treatment of timbers in Forest Service improvement work, the design of open-tank apparatus and recommendations to the public. At present there are 24 service-test projects in the Region which require periodic inspection and report.

One interesting test begun in 1915, to determine the suitability of pitch-treated lodgepole pine trees for poles, was published in 1930. It was found that lodgepole pine poles, treated by barking the living trees have an average life in the Montana region of about eight years. Untreated lodgepole pine poles will give an average life of about seven years. This short increase in life may be enough to pay for the cost of treating the poles, but thoroughly butt-creasoted poles treated by the open tank method would undoubtedly give

a longer life and prove more economical. The pitch treatment, therefore, has little to recommend it.

Properties

The Regional Office of Forest Products, working in cooperation with the Forest Products Laboratory, has made detailed studies of the properties and characteristics of the wood of several of the Region's little-used species (western larch, white fir and lodgepole) which will assist consumers in determining the suitability of the species for specific uses. The western larch study is now in manuscript form. The Region I contribution to the white fir study and the lodgepole pine bulletin are still to be prepared.

The remaining projects in products research are carried by the Forest Schools, each of which is making a real contribution to our knowledge of wood properties, seasoning, etc. Mr. Ramskill reported on a study at the University of Montana dealing with the electrical measurement of moisture in wood. This study is of a fundamental character and closely linked up with a study of the location and quantity of moisture in wood at various stages of the seasoning process to determine the governing factors and their relative influence. Dr. Hubert reported on a project at the University of Idaho also dealing with the movement of moisture in wood, but chiefly from the standpoint of its effect on decay. Both studies are progressing satisfactorily but must be continued for an indefinite period before results will be available.

The University of Montana is conducting a study of dry kiln practice, in cooperation with the White Pine Sash Col, a Missoula manufacturer, with the particular object of eliminating brown stain in western yellow pine during kiln drying. This investigation has led to several changes in dry kiln procedure resulting in material reduction of the brown stain injury. The results are not yet entirely satisfactory, however, and some further work is to be done.

The University of Idaho Forest School has initiated a study of the production of useful products from mill waste, woods waste and second quality timber. This work, which was begun in October, 1930, will include a study of the chemical properties and structure of wood constituents such as lignin and cellulose and the application of this knowledge to the utilization of wood constituents and the production of other substances from them. Several other products studies are underway at both Schools, but no results are ready for discussion at this time.

A study of the diagonistic characteristics of the woods of the genus Abies and a key based upon their identification characteristics has been finished at the University of Idaho and will be ready for publication shortly.

Grazing

There are a total of 13 projects in this field all conducted by the Regional Office of Grazing, two in cooperation with the University of Montana and one in cooperation

with the University of Idaho. This work is carried entirely by contributed time, many of the projects being handled by local forest officers under the supervision of the Regional Office. The amount of time and money that can be spared for this work is pitifully small in view of the importance of the grazing industry in Region I and the promising returns that adequate research offers. The Council strongly urges the expansion of grazing research in this Region.

Most of the projects now under way are continuing, long-time projects which have been reported on before in some detail. They include studies in growth, development and extension of range plants, artificial reseeding of ranges, stock handling, range carrying capacity, and in the eradication of poisonous plants. Two projects, dealing with the eradication of Delphinium and Hypericum perforatum, respectively, were completed in 1930. The results indicated that sodium chlorate properly applied is an effective killing agent with calcium chlorate somewhat less so. The spraying method of treatment gave best results.

Ecology

The selection and designation of natural areas probably represents the most important effort at present in the field of ecology. This work has been described in a previous section of the report. The urgent need for immediate action in setting aside carefully selected areas for future ecological study is

clearly recognized and selections are being made as rapidly as limited facilities permit.

The phenological project in which 26 observers, almost all on national forests, are recording certain selected biotic events as leafing, pollination, etc., has just completed its third year. This project is now undoubtedly on a firm basis. Most of the observers are systematic and thorough, and although some additional training is necessary the observational records being taken are undoubtedly a real contribution to this phase of botanical knowledge. The Experiment Station has recently finished a very brief progress report covering the first three years records and the forms have been revised and simplified to make future work somewhat easier. This project is to be continued for an indefinite period.

Establishment of an arboretum at the Priest River Branch Experiment Station is now well underway with thorough preparatory work accomplished in the way of mapping, topography, soil and site conditions (wet, moist, medium and dry sites), considerable cleaning up and disposal of fire-killed debris, poisoning of gophers, and planting of initial blocks of some native and exotic species. The area includes over a hundred acres and has just been fenced to exclude horses and cattle.

Mr. Larsen's report entitled "Forest Types of the Northern Rocky Mountains and Their Climatic Controls" was published in the October, 1930, issue of Ecology. This concludes work on

one of the old projects upon which Larsen was engaged before he left the Experiment Station some years ago. His remaining report in this field of work, which is to be called "Physical Factors of Site in Northern Idaho" is still to be completed.

The University of Montana continues its investigations of the site requirements of western yellow pine and a study of root competition and tolerance of western yellow pine. Progress was made on both studies during 1930, but there are as yet no results to report.

Silvics

There are no active projects under this field. The Experiment Station still intends to publish a bulletin pertaining to the silvics and management of western white pine based on twenty years of study and observation and it is hoped that Messrs. Weidman and Haig will be able to start work on this within the next calendar year. A manuscript by Mr. Larsen entitled "Conifers of the Northern Rocky Mountains" was submitted to the Branch of Research a year or more ago.

Dendrology

The most important event in this field has been the publication of the late Dr. Kirkwood"s monograph "Trees and Shrubs of the Northern Rocky Mountain Region." This publication, by an authority in his field, has been eagerly awaited by botanists and dendrologists in this region.

No other work is being carried or planned at present in the field of dendrology.

Economics

The Regional Office of Forest Products carried as usual a number of studies and canvasses in this field, about 30 per cent of its time being spent in this manner. The data collected include figures on the production of lumber and timber products within the Region, their cost of production, the prices both wholesale and retail at which they sold, and their distribution. Such information is necessary for a proper management of the National Forests and an understanding of the industry in general.

The lumber and timber products census was completed early in 1930 with a total of 408 sawmills and 212 miscellaneous timber operators being canvassed in addition to 171 returns from south Idaho, the editing and tabulation of which were handled by Region I. The preliminary returns for Idaho show a 1929 cut of more than a billion board feet, a gain of 5.2 per cent over the 1928 cut, and a total cut exceeded only in 1923 and 1925. The Montana figures for 1929 show a slight gain over the 1928 cut. With an average annual cut of approximately 388 million board feet for the past five years lumber production in Montana has been maintained at a very uniform level since 1924.

The usual annual collection of logging and manufacturing costs in the Region was made in 1930. Such cost figures are not only of interest to cooperators for purposes of comparison

but are used in arriving at production cost figures in many lines of Products and Logging Engineering work. In 1930 this study was expanded somewhat to include more detailed logging costs. Photostat copies of these detailed costs are sent to some 30-odd co-operators within 30 days after collection.

During 1930 the Regional Office of Lands completed the economic use survey of 60,000 acres of publicly owned and tillable land on the Custer National Forest, carried administratively over the last several years.

The University of Idaho has likewise completed an economic survey from a forest standpoint of Benewah County, Idaho. The report will probably be finished and published in 1931.

Two research projects in forest economics are also being carried by the University of Montana. One deals with forest taxation and the other with a study of the functioning, place and efficiency of cooperative protection agencies. Both projects are active and a preliminary report on the cooperative protective agency study has already been made.

ARTICLES AND PUBLICATIONS BY THE EXPERIMENT STATION

Submitted for Publication

1. Timber Growing and Logging Practice in the Northwestern Yellow Pine Region. R. H. Weidman. U.S.D.A. Bulletin,
2. A Five Year Record of Lightning Storms and Forest Fires in the Northern Rockies. H. T. Gisborne. Monthly Weather Review.
3. Conifers of the Northern Rocky Mountains. J. A. Larsen. U.S.D.A. Circular.
4. The Stocked Quadrat Method of Sampling Reproduction Stands. I. T. Haig. Journal of Forestry.
5. Stand Tables for Second-Growth Western White Pine. I. T. Haig. Northwest Science.

Published in 1930

1. Forest Fire Research. H. T. Gisborne. Scientific Monthly Vol. 31: 76-80. July 1930.
2. A Quarter Century of Silviculture in the Western White Pine Type. I. T. Haig. Forestry Kaimin of University of Montana, 1930.
3. Forest Types of the Northern Rocky Mountains and Their Climatic Controls. J. A. Larsen. Ecology Vol. 11: 631-672, October, 1930.

4. Investigations in Weed Control by Zinc Sulphate and Other Chemicals at the Savenac Forest Nursery. W. G. Wahlenberg. U.S.D.A. Tech. Bul. 156. January, 1930.

5. Experiments in the use of Fertilizers in Growing Forest Planting Material at the Savenac Nursery. W. G. Wahlenberg. U.S.D.A. Cir. 125.

6. Effect of Ceanothus Brush on Western Yellow Pine Plantations in the Northern Rocky Mountains. W. G. Wahlenberg. Jour. Agr. Research 41: 601-612. October, 1930.

7. After Advertising and Mergers - Then What? H. T. Gisborne. Editorial, The Timberman, August, 1930.

In Preparation or Proposed for 1931

1. Sources of regeneration Following Fires in the Western White Pine Forest. R. H. Weidman. Article.

2. A Silvicultural Study of Western White Pine. R. H. Weidman and I. T. Haig. U.S.D.A. Bul.

3. Results of Thinning Experiments in the Western White Pine Type. R. H. Weidman. Progress Report.

4. The Determination of Hour Control for Adequate Fire Protection in the Major Cover Types of the Northern Rocky Mountain Region. H. T. Gisborne and L. G. Hornby. U.S.D.A. Bul.

5. Atmospheric Indices of Forest Inflammability. H. T. Gisborne. Article.

6. Yield, Stand and Volume Tables for Second-Growth Western White Pine. I. T. Haig. U.S.D.A. Tech. Bul. (In manuscript.)

7. Reproduction and Residual Growth on Cut-over Areas in the Western White Pine Type. I. T. Haig. Final Report.

8. Comparative Timber Yields. I. T. Haig. Article. (In manuscript)

9. Recovery, Growth and Treatment of Understory Hemlock Released by Logging in the Western White Pine Type. I. T. Haig. Article. (In manuscript.)

10. Seed Germination During Natural Storage in Duff. R. H. Weidman and I. T. Haig. Note.

11. Growth and Yield of Western White Pine. I. T. Haig. Article. Submitted to Timberman, May 1931.

12. The Effect of Stand Composition on Yield in the Western White Pine Type. I. T. Haig. Article.

13. The Effect of Stand Composition, Site and Other Factors on Tree Volume in the Western White Pine Type. I. T. Haig. Article.

ARTICLES AND PUBLICATIONS BY THE R-1 PRODUCTS OFFICE

Submitted for Publication

1. Properties and Use Bulletin for Western Larch. R.P.A. Johnson and M. Bradner. Dep't. Bulletin.

2. Logging Output Bulletin. M. Bradner. Dep't. Bul.

3. Residual Wood After Logging in the Western White Pine Type. I. V. Anderson. Trade Journal Article.

Published in 1930

1. Log Damage on Gravity Chutes. I. V. Anderson. Trade Journal Article.

2. Fire Damaged Idaho White Pine Logs - What is the Loss? M. Bradner and I. V. Anderson. Trade Journal Article.

In Preparation for Publication 1931

1. Residual Wood After Logging in the Western Yellow Pine Type. I. V. Anderson. Trade Journal Article.
2. Residual Wood After Logging in the Larch-Douglas Fir and Lodgepole Pine Types. I. V. Anderson. Trade Journal Article.
3. Breakage Losses in Felling Important Trees of the Inland Empire. I. V. Anderson. Trade Journal Article.
4. Region 1 Contribution to White Fir Bulletin. M. Bradner. Dep't. Bulletin.
5. Properties and Use Bulletin for Lodgepole Pine. C. N. Whitney. Dep't. Bulletin.
6. Tree Values and Production Cost for Montana Western Yellow Pine. Recommendations for Selective Logging in Western Montana. M. Bradner. Trade Journal Article.
7. A Second Cutting of Yellow Pine in Western Montana. Results of Accidental Selective Logging Forty Years Ago. I. V. Anderson. Trade Journal Article.

ORDER OF EXPERIMENT STATION EFFORT PLANNED FOR F. Y. 1932

The following tabulation shows the relative order of effort to be devoted to projects and lines of work by the Experiment Station for the fiscal year 1932:

Lines of Work and Projects	Proposed Expenditures
Fire Protection	
Statistical & field study of hour control (Pf, D-1)	$10,500
Fire damage (Pf, A-1)	5,400
Weather and fuel relationships (Pf, B-5)	3,700
Fire weather forecasting (Pf, C-7)	1,300
Lightning and forest fires (Pf, B-1)	700
	21,600
	1,000
	20600
Methods of cutting--western white pine (Mc-102)	3,400
Management--Priest River Exp'tal. Forest	2,900
Reproduction--western white pine (Mr-102)	2,500
Tree study--western white pine bulletin (Ts-102)	1,400
Yield--western white pine (ME-102)	700
Thinning--western white pine (Mt-102)	700
Management	
Western yellow pine timber growing (M-Reqts.)	500
Selection of proposed experimental forests	500
Arboretum	400
Phenology	300
Total	$34,900

*The proposed project expenditures include overhead prorated over all the projects.

The amount to be devoted to fire protection research will be $21,600, to silvicultural research $9,900, and to the management & selection of experimental forests $3,400.

EXPERIMENT STATION STAFF F. Y. 1932

R. H. Weidman	Director
H. T. Gisborne	Silviculturist
I. T. Haig	Associate Silviculturist
____ _____	Associate Silviculturist
____ _____	Junior Forester
J. B. Thompson	Junior Forester
Anna J. Bramseth	Clerk

EXPERIMENT STATION BUDGET F. Y. 1932

	SI	S&E R-1	Imp.
Salaries (permanent staff)	$21,180		
Expenses (permanent staff)	2,400		
Sal. and exp. (other forest officers)	1,800		
Sal. and exp. (field assistants)	2,350		
Salaries (computers)	3,840		
Purchase of autos	1,300		
Maintenance of autos	600	75	
Supplies & equipment	1,230	140	
Freight, express & drayage	200	60	
Maintenance Branch Station		350	545
	$34,900	$625	$545

Allotment Estimates F. Y. 1932

Forest Experiment Station

Item	SI Salary	SI Expenses	S&E R-1	Imp.
R. H. Weidman	$4600	$600		
H. T. Gisborne	4200	600		
I. T. Haig	3200	400		
___ ___	3200	400		
J. B. Thompson	2180			
___ ___	2000	400		
Reg. For. Inspector*	1000	200		
Anna J. Bramseth	1800			
Computers (3)	3840			
Field Ass'ts.	1650	700		
Additional help**	500	100		
Purchase of autos		1300		
Maint. of autos		600	75	
Supplies & equipment		1230	140	
Frt., exp. & drayage		200	60	
Maint. Branch Station			150	545
Maint. team of horses			200	
	$28,170	$6,730	$625	$545

Total SI Allotment $34,900

*This covers 3 months' time of Regional fire expert cooperating with Gisborne on the hour control study.

** Covers time and expenses of two expert timber surveys men to make cruise and topographic map of 2000-acre addition to Priest River Experimental Forest.

LIST OF RESEARCH PROJECTS TO BE CARRIED IN 1931

By REGION I and NORTHERN

ROCKY MOUNTAIN FOREST EXPERIMENT STATION

Office of Forest Products

(1) Logging and Milling Studies
  - (a) Tree to Green Chain Studies
  - (b) Depreciation in fire damaged white pine
  - (c) A. C. M. relogging study

(2) Woods Utilization Studies
  - (a) Wood Waste
  - (b) Breakage
  - (c) Chute depreciation
  - (d) Log bucking for grade and size of lumber
  - (e) Utilization in small tie mills

(3) Durability of Woods in Service

(4) Little Used Species Studies

(5) Logging Output Studies

(6) Lumber Production Census

(7) Prices of Forest Products

(8) Distribution

(9) Logging and Manufacturing Costs

Office of Management

(1) Encroachment of yellow pine reproduction on grasslands

(2) Increment After Cutting in western yellow pine

(3) Increment after cutting in western white pine

(4) Increment after cutting in lodgepole pine

(5) Volume table for eastern Montana Douglas fir.

Office of Operation

(1) Adaptation and development of radio telephone equipment for field use

(2) Use of small tractors for fire-trench construction

(3) Use of explosives for fire-trench construction

(4) The relation of the occurrence of lightning fires to underlying geological formations

(5) Adequate Fire Control

(6) Aerial Photographic Mapping

Office of Planting

(1) Survival of planting on grassy bottom lands

(2) Yield and germinative energy of western yellow pine seed from various age classes

(3) Time of ripening of seed

(4) Yield and germinative energy of western white pine seed from various age classes

(5) Spacing in yellow pine plantations

(6) Spacing in white pine plantations

(7) Source of Englemann Spruce seed

Office of Range Management

(1) Range carrying capacity - Custer National Forest

(2) Range carrying capacity - Helena National Forest

(3) Artificial reseeding of ranges

(4) Methods of handling stock

(5) The seed factor in the management of ranges

(6) The growth, development and extension of range plants

Experiment Station

(1) Methods of cutting in western white pine forests

(2) Reproduction after cutting and forest fires in western white pine forests

(3) Methods of thinning western white pine stands

(4) The growth and yield of western white pine stands

(5) The growth and yield of western larch, Douglas fir and western red cedar in the white pine type

(6) Lightning in relation to forest fires

(7) Relation of weather to forest inflammability

(8) Fire-weather forecasting

(9) Determination of the factors involved in fire damage

(10) The speed and strength of attack necessary to attain successful fire control in the important timber types of Region I

(11) A silvicultural study of western white pine

(12) Growth and composition of virgin overmature western white pine stands

(13) Test of racial varieties of western yellow pine in northern Idaho

(14) Testing exotics and species native elsewhere in America for adaptability in northern Idaho

(15) Phenological observations on forest trees and subordinate vegetation to obtain definite knowledge on time and conditions of the seasonal vegetative events.

(16) Development of the 6000-acre experimental forest at Priest River.

December 10, 1930.

RS
Ts-101

Recommendation to Discontinue Project

Project: Silvicultural study of western yellow pine in the Northwest.

Scope: Preparation of Department bulletin.

Status: Field work by Weidman conducted chiefly in Region 6 between 1914 and 1921. Several office reports notably "Methods of Cutting Yellow Pine in Oregon" dated April 15, 1916, and "Yellow Pine Management Study in Oregon" dated May 10, 1917. Several articles on subject in Journal of Forestry in 1920 and 1921. A detailed outline for the silvicultural bulletin prepared and approved. The field work and reports served as a basis for the Public Requirements Study and report entitled "Timber Growing and Logging Practice for Western Yellow Pine in the Northwest" now in manuscript for Department bulletin.

STATUS SHEETS

Further Work: None contemplated at the present time.

Date of Completion: Indefinite

Assignment: Weidman

Reasons for Discontinuing: Since Weidman gave up the yellow pine silvicultural study on his departure from Region 6 in 1921, the Pacific Northwest Experiment Station has had Westveld, Kolbe and Meyer doing active work on various phases of the project. This work has added a great deal of new information which it would be a mistake not to include in a general silvicultural bulletin, if such a bulletin should be prepared. As the Pacific Northwest Station has most at stake and has made the more recent contributions to the study, it would seem to be the logical thing for

December 10, 1930.

RS
Ts-101

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Status: Field work by Weidman conducted chiefly in Region 6 between 1914 and 1921. Several office reports notably "Methods of Cutting Yellow Pine in Oregon" dated April 15, 1916, and "Yellow Pine Management Study in Oregon" dated May 10, 1917. Several articles on subject in Journal of Forestry in 1920 and 1921. A detailed outline for the proposed silvicultural bulletin prepared and approved. The field work and reports served as a basis for the Public Requirements Study and report entitled "Timber Growing and Logging Practice for Western Yellow Pine in the Northwest" now in manuscript for Department bulletin.

Further Work: None contemplated at the present time.

Date of Completion: Indefinite

Assignment: Weidman

Reasons for Discontinuing: Since Weidman gave up the yellow pine silvicultural study on his departure from Region 6 in 1921, the Pacific Northwest Experiment Station has had Westveld, Kolbe and Meyer doing active work on various phases of the project. This work has added a great deal of new information which it would be a mistake not to include in a general silvicultural bulletin, if such a bulletin should be prepared. As the Pacific Northwest Station has most at stake and has made the more recent contributions to the study, it would seem to be the logical thing for

December 10, 1930.

RS

Weidman to be relieved of this study in favor of the Pacific Northwest Station or only to retain his connection with it as a joint contributor in case of a general silvicultural publication. It is therefore recommended that this project be discontinued on the program of the Northern Rocky Mountain Experiment Station.

SCOPE: Work confined to plantations of one species on one site.

STATUS: Plantation at Priest River Branch contains 21 plots established between 1911 and 1917. Plots represent the races of western yellow pine from 19 localities over wide range of country from Black Hills to Siskiyou Mts. and from northern Idaho to Arizona and New Mexico.

RESULTS: Report entitled "Non-indigenous Western Yellow Pine Plantations in Northern Idaho" prepared December, 1927. This publication shows that the best results have so far been obtained from seed originating north of a line from the Black Hills in South Dakota to the Blue Mts. in Oregon. Stock from south of that line has not fared so well, and in several cases has suffered heavy to complete loss after being apparently established for 10 years or more.

FURTHER WORK: Periodic examinations at approximately 5-year intervals.

DATE OF COMPLETION: Indefinite

ASSIGNMENT: Weidman with assistance of Thompson.

December 10, 1930.

RS
Fs-101
Source-of-seed Plantations

PROJECT: Testing adaptability for northern Idaho of western yellow pine from numerous sources in western United States.

SCOPE: Work confined to plantations of one species on one site.

STATUS: Plantation at Priest River Branch contains 21 plots established between 1911 and 1917. Plots represent the races of western yellow pine from 19 localities over wide range of country from Black Hills to Siskiyou Mts. and from northern Idaho to Arizona and New Mexico.

RESULTS: Report entitled "Non-indigenous Western Yellow Pine Plantations in Northern Idaho" prepared December, 1927. This publication shows that the best results have so far been obtained from seed originating north of a line from the Black Hills in South Dakota to the Blue Mts. in Oregon. Stock from south of that line has not fared so well, and in several cases has suffered heavy to complete loss after being apparently established for 10 years or more.

FURTHER WORK: Periodic examinations at approximately 5-year intervals.

DATE OF COMPLETION: Indefinite

ASSIGNMENT: Weidman with assistance of Thompson.

RS
Fs-101 (c)

December 18, 1930.

PROJECT: Yield and germinative energy of western yellow pine seed from various age classes.

SCOPE: To determine the comparative value of seed as measured by yield and germinative energy in the various age classes of our yellow pine stands.

STATUS: Seeds gathered in 1930 from trees 0-20, 20-40 and 60-80 years. Germination tests under way.

FURTHER WORK: Completion of tests.

DATE OF COMPLETION: 1931

ASSIGNMENT: Olson

RS
Fs-102 (c)

December 18, 1930.

PROJECT: Yield and germinative energy of western white pine seed from various age classes.

SCOPE: To determine the comparative value of seed as measured by yield and germinative energy in the various age classes of our white pine stands.

STATUS: Seeds gathered in 1928 from trees 16 and 17 years old gave higher germination than seeds from old trees. Germination tests are under way for 9 lots of cones from trees in the 0-20 year class collected on the Clearwater.

Counts were made last fall of number of cones on trees in various age classes. The number increases rapidly up to the time the trees get to be about 45 years old, then as the crowns close in the cones are borne only on the tops and the number remains about the same. Even in old trees grown in the open, the cones are usually borne only on the upper part of the crown.

FURTHER WORK: Completion of germination tests. Compilation of data.

DATE OF COMPLETION: 1931

ASSIGNMENT: Olson, Jones.

RS
Fs-146 (d)

December 18, 1930.

PROJECT: Source of seed.

SCOPE: To determine the frost hardiness of Engelmann spruce while growing in the nursery and later at low and high elevations on planting sites, from seed of local climatic races.

STATUS: Much loss of growth results from frost nipping of spruce in the nursery and on the plantations. No work done in this region with local climatic races of seed. Seeds collected last fall from trees growing 3000 to 7000 feet above sea level, and from east and west side of continental divide. Germination tests under way.

FURTHER WORK: Installations of all lots to be made in nursery next spring and observations begin at once. Later to be planted in field and observations made periodically.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Olson

RS
Fp-101 (d)

December 18, 1930.

PROJECT: Spacing in yellow pine plantations.

SCOPE: To establish permanent plots of planted trees regularly spaced at different densities, for future observations in growth and natural pruning.

STATUS: Spacing plots were set out on the Wallace experimental area about 15 years ago, but the fail spaces were not replanted. Acre plots were planted last fall using 6x6, 8x8 and 10x10 spacing.

FURTHER WORK: Establish a companion plot spring 1931 using 15x15 spacing. Replant fail spaces and make periodic examinations.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Olson

RS
Fp-102 (a&d)

December 18, 1930.

PROJECT: Survival of planting on grassy bottom lands.

SCOPE: To determine suitable species and best methods of planting to get satisfactory establishment on creek bottom lands where vegetation, particularly grass, is luxuriant.

STATUS: Unchanged. No additional plots were established last year.

FURTHER WORK: Suitable stock is now available and new installations will be made spring 1931.

DATE OF COMPLETION: Possibly 1932.

ASSIGNMENT: Olson

RS
Fp-102 (d)

December 18, 1930.

PROJECT: Spacing in white pine plantations.

SCOPE: To establish permanent plots of planted trees regularly spaced at different densities for future observations in growth and natural pruning.

STATUS: Spacing plots were set out on the Wallace experimental area about 15 years ago, but the fail spaces were not replanted. Search was made last fall for typical white pine site where three, acre plots, easily accessible for future replanting fail spaces and for future observations, but no suitable area found.

FURTHER WORK: Select areas and plant acre plots using 6x6, 8x8 and 10x10 spacing.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Olson

December 10, 1930

RS
Mc-102

RS
Phenology
(Fs-101,102,141,146,161) December 18, 1930.

PROJECT: Time of ripening of seed.

SCOPE: Determine time when cones are ripe for drying, and seeds mature.

STATUS: Seed extracted and germination tests of all lots under way.

FURTHER WORK: Completion of germination tests. Compilation of data.

ASSIGNMENT: Olson

December 10, 1930

RS
Mc-102

PROJECT: Methods of cutting western white pine.

SCOPE: To determine suitable methods of cutting to secure satisfactory reproduction of the desired species, and the best development of residual stands.

STATUS: (1) Strip study of old cut-over areas: thirteen sale areas studied in 1925, two in 1926 and seventeen in 1928. These 32 areas sampled by 1807 mil-acre and 338 square-rod quadrats to obtain reproduction data. Increment of residual stand measured on 2814 trees on 143 one-tenth-acre and 15 one-fifth-acre plots. Over 8 miles of continuous strip run on cut-over areas to determine percentage of area stocked, and 496 chains of stand cruise made. This strip study covered 19 areas cut over by the selective method, leaving a residual stand; 11 areas clear cut, including 3 different types of seed-tree distribution; and 2 areas of shelterwood cutting.
(2) Permanent plot study: data gathered currently on 20 permanent sample plots, 18 of which have been established since the project was revived in 1926. All of these plots are also used in the natural reproduction study. Ten of them will furnish, in addition to other things, information on the proper treatment of hemlock in the western white pine type. These 20 plots contain 742 unscreened mil-acre quadrats re-examined annually to obtain information on seedling germination and establishment and 3,627 tagged trees re-examined at 5-year intervals to follow survival and growth of the residual stand.

RESULTS: Entire set of plots re-examined and two new plots established in 1930. Result of annual examinations only partially available due to insufficient office help to do compilations currently. Past results of temporary studies incorporated in eight manuscript and published reports and used in formulating methods of cutting policies in the western white pine type.

FURTHER WORK: Complete analysis of data and prepare final report on strip study. Re-examine annually reproduction quadrats on all permanent plots. When funds and personnel are available expand this series of plots to cover a wider range of conditions and methods of treatment.

DATE OF COMPLETION: Strip study in 1931. Indefinite on permanent plot study.

ASSIGNMENT: Weidman on the permanent plots. Haig on the strip study.

RS
Mr-101, D-1

December 10, 1930

PROJECT: Encroachment of yellow pine reproduction on grasslands.

SCOPE: To determine the rate and factors controlling the spread of reproduction on grasslands. To furnish information for improving administration of range and timber lands and to show whether the extension of forest by encroachment should be encouraged.

STATUS: Transect study begun in 1923. Three areas mapped and reproduction tallied and measured. Insufficient age data secured for analysis of rate of encroachment. Little field work done since and office work barely started. Situation due to greater urgency of administrative work. Weidman and W. W. White visited one of areas with Hartwell in 1924. A summing up of conclusions to date prepared by E. W. Hartwell and read before the Northern Rocky Mountain Section of the Society American Foresters early in 1928. This paper may be considered as a progress report. A small amount of information gathered in 1928 and 1929 in connection with other jobs.

FURTHER WORK: Preparation of progress report on work to date. Conduct field work on the 3 South Dakota ranger districts. Expand field work on the Long Pines district.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: E. W. Hartwell

December 10, 1930

RS
Mr-102

PROJECT: Reproduction after forest fires and after cutting.

SCOPE: To determine the factors controlling regeneration in the white pine type, with particular attention to seed production, dissemination, storage, germination, and seedling establishment.

STATUS: Ten permanent plots, nine on burned-over areas, one in uncut timber. (two plots established in 1929 incorporated in one, 1930). Eighteen plots on cut-over areas, listed under methods of cutting study, also used here, making a total of twenty-eight plots furnishing information on natural reproduction. These plots contain a total of 1204 reproduction quadrats, 740 one-thousandth acre in size, unscreened, and 291 one four-thousandth acre in size, screened. Two eight-year experiments using 48,000 seeds supply information on possible period of natural seed storage in the duff. Cone crop examinations of 4,696 tagged trees on permanent plots give data on seed production. Eighty seed traps supply additional data on seed production and dissemination.

RESULTS: Entire set of plots re-examined. Past results given in ten manuscript and published reports and used in formulating methods of cutting policies in the western white pine type. Current results only partially available due to insufficient office help to compile the data from annual examinations.

FURTHER WORK: During 1931, re-examine all permanent sample plots. When increased funds and personnel permit, establish other permanent plots covering a wider range of conditions; make further burning experiments to determine the effects of temperature, duff moisture content, and depth of seed in the duff on germination following fire; install more seed traps to study seed dissemination in burns and virgin stands; and conduct sowing experiments to determine effect of different surfaces or seed bed conditions on germination and survival.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Haig.

15 .1931

December 10, 1930.

RS
Mt-101, D-1

RS
Mt-102

PROJECT: Methods of thinning western yellow pine.

SCOPE: To determine suitable methods of thinning to secure the best development of young stands.

STATUS: Six permanent plots established on the Custer Forest. Plots 1 and 2 laid out in 25-year-old stand in 1918, but not tagged and numbered until spring of 1921. Plots 3 and 4 in 50-year-old stand and Plots 5 and 6 in 100-year-old stand tagged and measured in 1918 and remeasured in fall of 1922. Plots 1 and 2 measured again in fall of 1926, and Plots 3, 4, 5, and 6 in fall of 1927. Progress report submitted in March, 1928, by E. W. Hartwell. Measurements on Plots 1 and 2 made in 1928. Office compilation not completed.

FURTHER WORK: Continue remeasurements when due.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: E. W. Hartwell.

December 10, 1930

RS
Mt-102

PROJECT: Methods of thinning western white pine.

SCOPE: To determine suitable methods of thinning to secure the best development of young stands.

STATUS: Total of 11 permanent plots established at Priest River Station: 4 in 1914, 4 in 1919, 2 in 1925, and 1 in 1926. Remeasurement of first 8 plots in 1924. Compilation finished through cubic and board-foot volumes. Ten plots remeasured in 1929, oldest set being 15 years old. Two plots remeasured for first time in 1930.

FURTHER Prepare progress report. As preliminary results indicate advisability of thinning in stands younger than the 60 to 70-year-old timber of the existing plots, it is desired to establish 2 or 3 plots in a 35 or 40-year-old stand. As thinning ranks low in urgency as a problem, these plots will not be established in 1931, unless there is time left over from the major projects.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Weidman and Haig.

RS
ME-101, R-1

December 10, 1930.

PROJECT: Increment after cutting in western yellow pine.

SCOPE: To determine rate of growth of stands that remain after various kinds of cutting.

STATUS: No work has been done since last year, the status remaining the same as reported January 15, 1930. There are on hand 666 increment boring measurements from the Coeur d'Alene and 104 from the Pend Oreille which have not been worked up.

FURTHER WORK: Owing to the transfer of Mr. White from Management to Operation it is doubtful when these data can be worked up. It may be possible for Mr. White to spend some time on them later in the winter, if some help on compilation can be arranged. The project should be taken up on a much larger scale some time in the near future.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Office of Management.

December 10, 1930

RS
ME-102

PROJECT: The growth and yield of western white pine.

SCOPE: To prepare normal yield tables for the western white pine type and to work out application of such tables to natural stands. To study the development of young stands of various degrees of stocking on permanent sample plots.

STATUS: Twenty-six permanent and fifty-eight semi-permanent plots established to date as a source of information on growth and yield. In addition, yield data have been gathered on 306 temporary yield plots, 58 of which are now included in the semi-permanent series. Seventeen permanent plots given their first half-decade remeasurement in 1928 and 1929. Four permanent and twenty-three semi-permanent plots given their first half-decade remeasurement in 1930. One pair of permanent plots will furnish data on the practical value of pruning to a height of 17 feet to produce clear lumber in the first log. 23.

RESULTS: Preliminary yield and volume tables for second-growth western white pine circulated in mimeograph in 1927. Complete yield, stand and volume tables now ready in manuscript.

FURTHER WORK: For 1931: Finish final report on normal yield study. Remeasure two permanent plots. Remeasure thirty-three semi-permanent plots installed during yield study in 1926. Detailed study of application of yield tables and further expansion of permanent plot series to be undertaken when funds and personnel are available. 33

above should equal 58

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Haig.

RS
ME-102,(R-1)

December 10, 1930.

PROJECT: Increment after cutting in western white pine.

SCOPE: (1) To determine rate of growth of stands that remain after various kinds of cutting.

(2) To find out something about why some western white pine trees will show a marked acceleration, others a retardation, and still others no change in diameter growth rate after release by cutting.

STATUS: No work was done on this project in 1930. Increment borings from the Coeur d'Alene and Pend Oreille have not been worked up.

FURTHER WORK: Owing to Mr. White's transfer from Management it is doubtful when this work can be done.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Office of Management.

RS
ME-103, R-1

December 10, 1930.

PROJECT: Increment after cutting in lodgepole pine.

SCOPE: To determine rate of growth of stands that remain after various kinds of cutting. How long after cutting does it take trees of various sizes to reach tie size?

STATUS: No work done in 1930.

FURTHER WORK: Nothing further planned at present. The project is not being dropped, since it will probably be renewed at some future time.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Office of Management.

December 10, 1930.

RS
ME-141

PROJECT: Growth and yield of western larch on permanent sample plots.

SCOPE: To study the growth, loss and development in young larch stands by a restricted number of plots on demonstration forests. To serve partly as a basis for the management of larch on such areas.

STATUS: Preliminary yield measurements by Brewster on Blackfeet and Flathead Forests which may be used when time comes for a yield study in larch-fir type. One 10-year-old plot, established by Larsen in 1916 and re-established on a permanent basis in 1926.

RESULTS: No current results. Past results given in report by D. R. Brewster, entitled, "Growth and yield of western larch in larch-fir type of Northwestern Montana."

FURTHER WORK: Remeasure one permanent plot in 1931. Establish 2 or 3 additional yield plots in larch at Priest River Experimental center whenever convenient.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Haig.

RS
ME-161, R-1

15, 1931
December 10, 1930.

PROJECT: Volume table for eastern Montana Douglas fir.

SCOPE: Construction of a volume table applicable to eastern Montana Douglas fir which varies considerably in form from Idaho and western Montana fir.

STATUS: ~~About 250~~ Total of 402 tree measurements have been secured on the Beaverhead Forest & Lewis & Clark last year. ~~It was intended to secure about that number this year, but only 18 new measurements were obtained.~~

RESULTS: None to date.

FURTHER WORK: Compilation of data to be done by Washington Office. ~~Collecting 200 to 250 additional measurements and construction of volume table.~~

DATE OF COMPLETION: ~~Spring of 1932.~~

ASSIGNMENT: ~~Definite assignment of the job to collect measurements will be given to the Beaverhead and Jefferson Forests.~~

COMPILATION: By Office of Forest Management.

December 10, 1930

RS
ME-182

PROJECT: Growth and yield of western red cedar on permanent sample plots.

SCOPE: To study growth of this species as it occurs in the understory of white pine stands. Work restricted to five plots.

STATUS: Cedar understory trees tagged on three white pine thinning plots, and one hemlock understory plot. One small (0.10 acre) plot established in normally stocked cedar bottom type, 70-year age class. All plots remeasured in 1929 and 1930.

FURTHER WORK: Remeasure tagged trees on these plots at 5-year intervals. No extension contemplated.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Haig.

December 10, 1930.

RS
ME-1,
Regional Growth and Yield

PROJECT: Regional growth and yield.

SCOPE: Maintain file containing tables, graphs, and other information on volume, yield, form, diameter, height, etc., of all species of the region.

STATUS: File set up in 1926 and material received added currently. Bibliography of material on hand prepared in 1930.

FURTHER WORK: File to be added to as current work produces additional material.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: Haig and other members of staff.

December 10, 1930

RS
ME-2
Converting Factors

PROJECT: Converting factors.

SCOPE: Maintain file containing all converting factors of use in the region for converting one unit of timber measurement into another, as board feet into cubic feet, poles and ties into board feet, etc.

STATUS: File set up in 1926 and material received added currently.

FURTHER WORK: Maintain file.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: Haig and other members of staff.

December 10, 1930.

RS
Me-3,
Manual of Research Methods

PROJECT: Manual of research methods.

SCOPE: Maintain file dealing with forms and methods of collecting and compiling field data.

STATUS: File set up in 1926 by assembling in it material previously filed under "Revision Research Manual", "Forms" and "ME-3, WO".

FURTHER WORK: Maintain file.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Weidman and members of staff.

December 10, 1930

RS
M-1
Private Forestry

PROJECT: Development of private forestry.

SCOPE: Collection of facts relating to the development of private timber-growing practice in the region and assist private owners in every way possible.

STATUS: Facts regarding private forestry practice, which in this region consists mainly of intensive fire protection and slash disposal, collected for the committee of the Society of American Foresters engaged in making a private forestry survey. Collection of records of practice of forestry by private enterprise is a continuing project handled by the Regional Forester through the Supervisors. Operations of the Clearwater Timber Company visited in 1929 and records obtained showing the forestry measures now being practiced by this company, especially the selective logging and good brush disposal in the younger age classes of western white pine. Continued development of the Priest River area to increase its demonstration value in furthering private forestry.

RESULTS: Using Haig's white pine and Behre's yellow pine yield tables as a basis, an illustrated leaflet was prepared in non-technical style by the Experiment Station, describing the yields, values, and advantages of holding and protecting second-growth timber in northern Idaho and western Montana. A first edition of 10,000 copies distributed. "Show-me Trip" for Priest River business men conducted in 1930.

FURTHER WORK: Continue collecting the facts and aid in encouraging private owners. Conduct "Show-me Trip" for Timber Products Bureau, Spokane Chamber of Commerce, during 1931.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Experiment Station, Region and National Forests.

December 10, 1930.

RS
M-Experimental Forests

PROJECT: To select sizeable areas representing each of the timber types of the region within which to concentrate the bulk of the permanent sample plots, experimental cutting, thinning and other research work of the Regional Experiment Station. Although actual experimental work may not in all cases be started now, selection and setting aside of the areas is necessary to assure their existence when needed.

SCOPE: Select areas of 3000 to 6000 acres, approximately, suitable for the purpose from the standpoint of representing the type, diversity of age classes, including young, middle-aged and virgin, as well as some cut-over area if possible, variety of sites and aspects, etc. There should be at least six such experimental forests set aside for research and demonstration forestry in the northern Rocky Mtn. region.

STATUS: The Priest River experimental area representing the northern portion has been in use for nearly 20 years. The Bernice area representing the lodgepole pine type was set aside on the Deerlodge Forest more than 10 years ago. A larch-fir area was selected on the Flathead Forest in 1929. A number of field examinations have been made in search of a typical yellow pine area and of two additional white pine areas to represent the middle and southern portions of the latter type. Two additional areas in the white pine type have been tentatively selected during the past year, one on the Burnt Cabin Cr. drainage of the Coeur d' Alene and one on the Pine Cr, drainage of the Clearwater Forest. The Coeur d' Alene area represents the middle portion and the Clearwater the southern portion of the white pine type.

FURTHER WORK: Continue reconnoitering for the yellow pine and white pine areas in 1931. Report formally on the larch-fir area following a field examination of boundaries, etc.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Weidman and Koch.

December 10, 1930

RS
M-Research Reserves

PROJECT: To insure the preservation of areas of virgin timber stands representing each of the important forest types in the region, to meet the needs of science and education.

SCOPE: To select and to designate for preservation certain areas large enough to typify virgin condition in the western white pine, western yellow pine, fir-larch, and lodgepole types.

STATUS: One area representing the climax stage of the white pine type has been surveyed and designated within the Priest River Experimental Forest. Proposed areas which have been either reconnoitered or examined in some detail, and for which maps, cruises and description data have been obtained include the following: Bottle Creek, 460 acres, white pine, Kaniksu Forest; Humbird, 160 acres, white pine, Kaniksu Forest; Musselshell, 360 acres, white pine, Clearwater Forest; Turners Flat, 115 acres, white pine, St. Joe Forest; Moose Creek, 1600 acres, cedar, East Selway Forest; Little Trapper Cr., 320 acres, yellow pine, Bitterroot; Coram, 320 acres, fir-larch, Flathead. For the lodgepole type an area is proposed within the Bernice Experimental Area on the Deerlodge Forest. Yellowstone and Glacier National Parks will always offer ample opportunity to study natural virgin conditions in lodgepole and Engelmann spruce on a large scale.

RESULTS: One area in white pine permanently designated. Other areas surveyed and cruised and data ready for preparation of report.

FURTHER WORK: Continue field examinations of other areas and report this year on those upon which a decision has been reached.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Weidman and Koch.

December 10, 1930

RS
M-Priest River Branch

PROJECT: Development of the experimental forest at Priest River, which now contains a little over 6000 acres.

SCOPE: Establish and maintain experiments and permanent sample plots in yield, reproduction, thinning, methods of cutting, planting, and intensive methods of fire protection, in order to work out principles and to have examples of various practices for demonstration purposes.

STATUS: There are now 37 permanent plots devoted to the above purposes within the area and 5 plots immediately outside its boundaries. Among these are two permanent experiments established by the Western Office of Blister Rust Control and conducted cooperatively. In addition to these larger plots there are hundreds of permanent reproduction quadrats, a number of seed traps, and two 8-year seed storage experiments. A 15-acre timber sale cutting has a permanent record in the form of map, tagged seed trees, reproduction quadrats and notes on slash disposal, etc. A large arboretum area has been mapped, and considerable planting of exotics done. The intensive trail system of the area was practically completed in 1929, bringing the total distance to over 50 miles and making every point in the forest within 15 minutes' walk from a trail. The buildings and grounds are now being kept up annually according to a 5-year improvement program. The water system is being entirely replaced over a four-year period with annual expenditures of $700, 1930 being the second year of this project. The Branch Station continues to be used for ranger and guard training camps and for an annual two-weeks' field trip of Idaho Forest School Students.

FURTHER WORK: Establish a check plot for the Borggreve thinning. Negotiate timber sale including area already marked for the establishment of seven methods-of-cutting plots at the head of Benton Creek.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Weidman and Thompson.

December 10, 1930.

RS
Pf, B-1

PROJECT: Lightning in relation to forest fires.

SCOPE: To observe and record the important characteristics of thunderstorms passing over the forests of Region 1. To analyze the records and to present results in terms of number of fires and possibilities of obtaining warnings and forecasts.

STATUS: Systematic observations of lightning storms commenced in 1922. Report form revised in 1924 and again in 1929. New form accepted for use on all National Forests west of the Mississippi River. Over 200 stations now making observations in Region 1. Data are tabulated on punch cards and sorted and analyzed annually.

RESULTS: Report of analysis for 1922 to 1925 inclusive published in Monthly Weather Review, July, 1926. Applicable results of study through 1926 condensed and sent out as a circular letter to Region 1 Forests in 1927. Analysis of 14,754 reports for 1924 to 1928 inclusive recently completed and report accepted for publication by Monthly Weather Review. This study has provided more accurate and more extensive information on several phases of the lightning fire problem; it has caused the lookouts to watch storms and fires more intently and more intelligently, and much of the information obtained is being used currently for improving fire control.

FURTHER WORK: Continue drive for more complete reports and prepare to make detailed and perhaps final report after ten years of record are collected on the new form. Analyze results annually and report briefly to field force showing mainly the peculiarities of the season.

DATE OF COMPLETION: Probably 1940.

ASSIGNMENT: Gisborne, with cooperation of Regional Office and 200 lookouts in Region 1.

December 10, 1930

RS
Pf, B-5

PROJECT: Relation of weather to forest inflammability.

SCOPE: To determine the effect of the various weather elements on the inflammability of forest materials. To devise methods of measuring existing inflammability.

STATUS: Twice daily measurements have been made of duff moisture as affected by atmospheric conditions for nine seasons, and for wood moisture for five seasons, on clear-cut, half-cut, and fully-timbered exposures. Duff hygrometer is being used for measuring duff moisture content, and graduated sizes of wood cylinders for wood moisture. For five years, wood, twig, and duff samples were collected periodically to check the applicability of these measurements. Three new and very satisfactory inflammability stations with more complete equipment commenced in operation in 1930, to supersede the previous three, on clear-cut, half-cut, and full-timbered areas. Preliminary studies of fire behavior have been made during three fire seasons using both the general observational and the sample plot methods to investigate the topographic, wind, fuel mass, fire position, fire momentum, and other major factors of forest inflammability.

RESULTS: Duff hygrometer method being used on seven National Forests and by the District Office as criterion of duff inflammability. Experience over a period of years is resulting in more and more dependence being placed upon these measurements. Improved measurements at three inflammability stations are showing very clearly the great importance of shade of forest canopy in reducing duff and litter temperatures, hence in maintaining higher moisture contents and greater safety from fire.

FURTHER WORK: Make statistical analysis of all twice daily measurements on three sites to determine more accurately the effects of each of the weather elements on duff and wood moisture and therefore inflammability. Extend measurements to include effects of soil moisture, and amount, quality, and effect of sunlight. Continue development of technique of studying going fires after results so far obtained are carefully analyzed.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Gisborne in cooperation with Products Laboratory. If increased funds permit addition of new fire research man this project should be turned over by Gisborne to the new man as rapidly as possible.

December 10, 1930.

RS
Pf, C-7

PROJECT: Fire-weather forecasting.

SCOPE: To improve the weather forecasts for the forested portions of Region 1 by co-operation with the U. S. Weather Bureau at Spokane.

STATUS: In order to provide the Spokane office of the Weather Bureau with more localized and detailed daily reports on the weather in the Forests, nine Forest Service stations co-operate by making measurements and telegraphic or telephone reports to Spokane. Several other Forest Service stations assist by reporting daily by mail. All submit ten-day reports on standard forms. At some of the stations the Forest Service provides the meteorological instruments used. Most of the equipment, however, is furnished by the Weather Bureau. Gisborne assists by serving as liaison officer between the Spokane office of the Bureau and the Regional Office of the Service. Early in 1930 a very complete fire-weather station was established in Missoula through the co-operation of the U. of Montana School of Forestry, which is loaning most of the equipment, the Spokane office of the Weather Bureau, which supplied some additional equipment and supervised the installation, and the Forest Service, which provides for operation of the station during the fire season.

RESULTS: A steady improvement in the detailed nature and accuracy of the forecasts is being granted by the Supervisors who are in consequence using the forecasts more in their fire control work.

FURTHER WORK: Continue liaison work, and install new stations as needed.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Gisborne and local Forest officers co-operating with the Weather Bureau. This project also should be turned over to one of the new fire research men as soon as possible.

December 10, 1930.

RS
Pf, D-1

PROJECT: A statistical analysis of the Region I fire records to determine the hour control or speed of attack necessary to attain successful fire control, according to strength of attack, for each important timber and fuel type in this region, for average seasons, for average easy seasons, and for average bad seasons. This is a new project.

SCOPE: The first work will be confined to the Forest Service records for the period 1921 to 1930 inclusive. This may later be extended to cover State and private forest areas if their records permit, and may also include Forest Service records for years previous to 1921 if that seems desirable.

STATUS: Preliminary work commenced in June 1930 by sacrificing effort on other fire projects. The detailed objectives and scope outlined by the Regional Forester, Experiment Station Director, and members of their offices. At a conference at Berkeley attended by Kotok, Show, Reinecke, McArdle, and Gisborne, agreement was reached on the mechanical details of using the Hollerith punch card system in this analysis. Later a detailed code system was devised after conferences with numerous Regional Office men to suit R-1 conditions and objectives as well as possible. The original fire reports have been called in from all Forests and the Regional Office is assigning one experienced man from each of the western Forests to assist in checking and coding the reports. This work is now under way.

RESULTS: None to date.

FURTHER WORK: Upon completion of the coding the Experiment Station will be responsible for the punch-carding, while the sorting and final compilation will be according to agreements with the Regional Forester to develop all possible information from these data. First effort is being concentrated on those Forests on which the Transportation Study is being prosecuted because accurate hour control data are fundamentally important in this study.

DATE OF COMPLETION: 1932 or 1933.

ASSIGNMENT: Whoever may be selected to represent the Regional Office, with Gisborne from the Experiment Station.

December 10, 1930

RS
TS-102

PROJECT: Tree study of western white pine.

SCOPE: Preparation of a Department bulletin.

STATUS: Field work done by numerous men in the last 15 years. A manuscript for bulletin prepared by Rockwell in 1917. Much additional work by the Experiment Station in yield, reproduction, methods of cutting and slash disposal renders a great deal of Rockwell's data inadequate and out of date. His report will merely furnish part of the material from which a new manuscript must be written.

FURTHER WORK: Preparation of manuscript.

DATE OF COMPLETION: 1932.

Assignment: Weidman and Haig.

December 10, 1930.

RS
TS-102
Permanent Sample Plots

PROJECT: Growth and composition of virgin overmature western white pine stands.

SCOPE: To study growth and progress towards the climax type in virgin overmature western white pine stands.

STATUS: Two permanent plots on which all trees are tagged, one established in 1922 and one in 1927.

RESULTS: None to date.

FURTHER WORK: Remeasure permanent plots at 5-year intervals. Establish a few additional plots, particularly in research reserves on experimental forests, as time and opportunity permits.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Weidman and Haig.

December 10, 1930

RS
T-1

PROJECT: Forest Types and their controlling factors in the northern Rocky Mountains.

SCOPE: To determine the factors controlling the distribution and composition of forest types.

STATUS: Field work completed 9 years ago. Report, "Physical Factors of Site in Northern Idaho" turned over to J. A. Larsen, now at Iowa State College, for preparation and publication on his own responsibility.

RESULTS: One report, "Forest Types of the Northern Rocky Mountains and their Climatic Controls" published in Ecology, 1930.

FURTHER WORK: To be finished by J. A. Larsen.

DATE OF COMPLETION: 1931 or 1932.

ASSIGNMENT: J. A. Larsen.

December 10, 1930

RS
B-Arboretum

PROJECT: Testing exotics and species native elsewhere in America for adaptability in northern Idaho.

SCOPE: Arboretum area of 160 acres at Priest River Branch containing various aspects, soils, dry and marshy sites. Early frosts and summer drouth make for a short growing season. Early planting experiments with exotics here indicate what species may be tried out with hope of success. Planting is to be limited to such species. As far as possible as much as an acre is to be devoted to each species in order to secure in each case a plot large enough to produce forest conditions at maturity of the trees.

STATUS: Detailed topographic map made of the area. Remnants of early plantings of Picea excelsa, Pinus monticola, P. ponderosa, P. contorta on part of area. Small groups of Larix dahurica, Larix kurilensis, Picea sitchensis, Tsuga mertensiana, Thuja orientalis, Abies magnifica, and Chamaecyparis nootkatensis planted last spring. Pinus peuce being grown at Savenac Nursery for planting next year. This 5-needled species is being introduced on the strength of its reputed resistance to white pine blister rust. Part of area classified and mapped as to character of site, i.e., dry, moist and wet.

FURTHER WORK: Make preliminary soil classification on part of area not covered by the original survey by the Bureau of Soils. Classify and map dry, moist and wet sites on remainder of area and make soil acidity tests. Allocate ground systematically for genera and species. Plan definitely on acquiring stock each year from various nurseries and by growing it at Savenac Nursery.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Weidman and Thompson.

December 10, 1930.

RS
B-Phenology

PROJECT: Phenological observations on forest trees and subordinate vegetation to obtain definite knowl edge on time and conditions of the seasonal vegetative events.

SCOPE: Observations at a number of stations in Montana and northern Idaho to represent the white pine, yellow pine, larch-fir, and lodgepole pine types. Observations to be taken weekly throughout the growing season at the same sites for a number of years.

STATUS: Instructions issued April 30, 1928, by the Regional Forester to start the observations at 27 stations on the National Forests. In addition observations were started at the Priest River Branch Station, at Yellowstone and Glacier National Parks. Simple micro-dendrometer ordered for testing in the determination of the beginning and ending of diameter growth.

FURTHER WORK: Collect and check reports from the various stations annually. Make first compilation in three to five years after inauguration of project.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Weidman and Haig.

RP
Lumbering
Logging and Milling Studies

December 20, 1930.

OBJECT and SCOPE

The objectives of this project are:

1. To determine the conversion value of all commercial forest types in the Region. Values to be shown on an individual tree and acreage basis for various systems of cutting and to be used as a basis for establishment of selective logging throughout the Region.

2. To make available to outside agencies data fundamentally useful in the promotion of private forestry.

3. To make a check on the amount of overrun obtained by use of the Scribner Decimal C rule under standard Forest Service practices at regular intervals.

4. To reduce economic waste in lumber manufacture by efficiency studies of different types of equipment and methods of manufacture.

5. To secure accurate information currently on the amount of sawmill wood waste being produced in the Region.

6. To determine volume and value depreciation based on lumber values for:

a. various methods of log transportation.
b. various methods of lumber handling and seasoning.
c. fire-killed timber.
d. bug-killed timber.

STATUS

Three field studies in the yellow pine type were completed in 1928. Field work for another was completed November, 1930. These studies were carried out in co-operation with the A. C. M. Company and the J. Neils Lumber Company, with the Regional office of Forest Management co-operating in all four studies. To date reprints from five trade journal articles have been distributed in presenting the results of the sawmill studies of 1924 and 1925. The depreciation study of fire-damaged white pine was completed last year.

PROGRESS DURING 1930

Data for the third yellow pine study area were compiled, analyzed and prepared for presentation. The following data are now available for the three areas individually or combined. Graphs, charts or tables by one-inch-diameter classes for the average yellow pine tree showing; log scale, lumber tally, per cent of grades, production costs and lumber selling values, also per cent of grades by logs for 14-, 24-, 31- and 38-inch trees.

Data were also compiled and made available from the tree studies on: the effect of tree height on value of western yellow pine, a comparison of built-up tree values versus actual trees, a volume and value comparison by tree D.B.H. of western yellow pine logs of similar size and tree position, and a comparison of log and tree values based on a piece tally by width and thickness versus values based on the average grade value.

In addition to the output curves made in 1929 showing output by tree sizes for tractor skidding, felling and topping and bucking at the landing, curves were prepared showing output by tree sizes for long log tractor skidding and felling, bucking and limbing in the woods. Charts were prepared showing comparison of tree length tractor skidding versus long log skidding, driver efficiency and machine efficiency.

Results of the fire-damaged white pine depreciation study were presented by a trade journal article and reprints circulated to the industry. The white pine bug depreciation study was not carried out because of nonoperation of the plant where the study was to have been carried out.

FURTHER WORK

Compilation and preparation of a series of trade journal articles on the three yellow pine tree studies and a report for circulation to western Montana operators in the A. C. M. relogging study. A similar study is contemplated for 1931 providing arrangements can be made for the necessary co-operation with the Experiment Station, the University of Idaho, a representative white pine operator and any other interested agencies. A tree study is also planned for the L-DF type as soon as time will permit. There still remain considerable data in the tree studies and in the white pine fire depreciation study on sawmill practices, yields, costs and overrun which should be analyzed and presented to the industry when time will permit.

DATE OF COMPLETION

Yellow pine tree studies available in reprint form by July 1, 1931. A. C. M. relogging study report available by March 1, 1931. White pine and L-DF tree studies indefinite. The general nature of this project is continuous.

ASSIGNMENT

Bradner and Anderson.

RP
Utilization & Waste Investigations
Woods Utilization Study

December 20, 1930.

OBJECT and SCOPE

This project has three objectives. They are:

1. An inventory of residual wood after logging.

2. A determination of present-day utilization in logging and small sawmilling in Region One.

3. Development of improved methods of utilization in logging and small sawmilling.

Specific studies under captions 2 and 3 that have been initiated are: log bucking for grade and size of lumber, loss from breakage in felling, loss from breakage in gravity chuting, and utilization in small tie sawmills.

STATUS

Wood Waste Inventory

Field	Compilation	Presentation
Y.P. Type - complete	100%	none
W.P. " - "	100%	"
L.P.P." - "	100%	"
L.-D.F." - "	90%	"

Breakage Study

Y.P. Type - complete	100% complete	none
W.P. " - "	90% "	"
L.-D.F." - "	90% "	"

Chute Depreciation Study

Complete	Complete	Complete

Log Bucking for Grade and Size of Lumber

This project just initiated. Preliminary work plan prepared.

Utilization in Small Tie Sawmills

50% complete	10% of data collected to date	none

PROGRESS DURING 1930

Wood Waste Inventory

During the 1930 field season one permanent Products man was in the field a total of 83 days. A field assistant was employed for a total of 124 field days and 71 field days were contributed by detailed rangers throughout the Region.

Field work for the lodgepole pine and larch-Douglas fir inventories was brought from 30% to 100% completion and 0% to 100% completion respectively.

Office compilation was completed for the lodgepole pine and larch-Douglas fir types.

Breakage Study

Field work for the white pine and larch-Douglas fir projects was brought from 30% to 100% completion and 0% to 100% completion respectively.

Chute Depreciation

Trade journal article prepared and reprints circulated.

Log Bucking for Grade and Size of Lumber

A tentative work plan has been prepared and preliminary analysis made of tree data essential to intelligent execution of project. Field forms prepared and printed.

Utilization in Small Tie Sawmills

Approximately 1700 short logs (8½ foot) were followed through two representative mills. Only 10% of data collected to date compiled.

FURTHER WORK

Woods Waste Inventory

Completion of compilation and preparation of trade journal article.

Breakage Study

Completion of compilation and preparation of trade journal article.

Chute Depreciation

Completed. No further work anticipated.

Log Bucking for Grade and Size of Lumber.

Preliminary mill work to determine number of men required to secure desired data, final mill study, check of conclusions and application to actual practice.

Utilization in Small Tie Sawmills

Compilation of data and preparation of progress report and sawed tie-volume table for larch-Douglas fir. Additional time studies and analysis of small sawmill efficiency.

DATE OF COMPLETION

General nature of the project is continuous. Inventory and breakage completed by March 1, 1931. Bucking for grade and tie sawmill projects completed by April 1, 1932.

ASSIGNMENT

Anderson.

RP
Wood Preservation
Durability of Woods in Service

December 20, 1930.

PROJECT — Durability of woods in service.

OBJECT — To determine the durability of treated and untreated local woods in actual service and the efficiency of various preservatives including results of treatment by different processes.

STATUS — Experimental work needed while new wood preservatives are being introduced by the manufacturers has led to the installation of several new field tests within the past few years. At present there are 24 service-test projects in this Region which require periodic inspection and report. This work is done currently. Some assistance is received from the Forest Supervisors.

PROGRESS DURING 1929 — Twelve inspections were made during 1930. Reports were completed for eight of these projects. The treating and installation of lodgepole pine stubs in the Bozeman-Flathead Telephone line, started by the Gallatin Forest in 1929, was completed on September 17, 1930. A comprehensive report covering all parts of the work was prepared. While it was originally proposed to treat 200 stubs on 6 to 7 miles of the line alternately with creosote and treater dust, the Anaconda Copper Mining Company later advised the use of their wood preservative paste as being more effective than treater dust. The plan was, therefore, modified with a view to securing comparative records on treater dust, paste and creosote treatments. The test strips included now cover approximately 10 miles of the line with a total of 299 experimental stubs. Two new tests not listed in the program for 1930 were installed by the Missoula Forest. In both cases the telephone poles and stubs set were treated with Anaconda wood preservative paste. The timbers marked for future examination consisted of 50 lodgepole pine poles and stubs in the Missoula-Monture line and 48 western larch poles in the Mt. Henry Telephone line. The lodgepole pine fence posts at the Ammen Place, and western hemlock ties in the Northern Pacific test track at Missoula, listed for inspection in the 1930 program were not inspected.

FURTHER WORK — The following projects will be inspected during 1931:

Project L-50 - Northern Pacific Test Track-Ties, Thompson Falls, Montana.

" " - Northern Pacific Test Track-Ties, Plains, Montana.

" L-214 - Northern Pacific Test Track-Ties, Missoula, Montana.

" " - Experimental Fence Posts at Ammen Place, Missoula, Montana.

Project L-214 - Dillon - Rattlesnake Telephone Line, lodgepole pine poles, Beaverhead Forest, Montana.

" L-44 - Anaconda Copper Company mine timbers, Butte fence posts and poles, Rocker, Montana.

" L-214 - Livingston-Main Boulder Telephone Line, arsenic-treated stubs and poles, Absaroka Forest, Montana.

" " - Sunnyside Ranger Station Fence, arsenic-treated posts, Deerlodge Forest, Montana

" " - King's Hill-Cook Ranch-Two Dot Telephone Line, arsenic-treated poles, Jefferson Forest, Montana.

" " - Hebgen-West Yellowstone Telephone Line, arsenic-treated poles, Madison Forest, Montana.

" " - Gates of Mountains Transportation Co., arsenic-treated telephone poles. Helena to Hilgers' Landing, Montana.

The Forest Supervisors of the Absaroka, Deerlodge, Jefferson, Madison and Helena Forests will continue to make annual inspections and reports on the arsenic-treated timbers of the last five tests listed under Project L-214.

Replacement records for the untreated C.M.St.P. & P. poles from Harlowton, Montana, to Avery, Idaho, and the Montana Power Company creosoted poles in the Harlowton-Roundup Billings line will be summarized. In preparing these reports it is planned to include some data from an inspection of several test sections in both projects in August, 1929.

In order to bring the records up to date it will be necessary to secure a statement from the C.M.St.P. & P. Ry., Company covering their stubbing work for the past three years. Maintenance of the untreated poles by stubbing has been in progress for the last five years covering all poles in need of re-enforcement throughout the entire electrified section of 440 miles.

DATE OF COMPLETION: Continuous.

ASSIGNMENT: Whitney.

RP
Properties and Use Bulletins
Little-Used Species Project

December 20, 1930.

PROJECT — Properties and Use Bulletins.

OBJECT and SCOPE — To prepare or assist in preparing bulletins to furnish detailed information on the properties and characteristics of the wood of several of the Region's litte-used species (western larch, white fir, and lodgepole) which will assist consumers in determining the suitability of the species for specific uses. Generally it is intended to promote the good utilization of such species, thereby increasing the economic value of this source of our present timber supply.

STATUS — M. Bradner and R. P. A. Johnson of the Laboratory were assigned co-authors to prepare for publication the "Properties and Use" bulletin on western larch. Bradner's original manuscript covering character and range, cut and supply, grades and their characteristics, seasoning, marketing.distribution, etc., was completed in November, 1929, and sent to the Laboratory to be incorporated in the bulletin. This section of the bulletin was based in part on the western larch memorandum prepared in the R-1 office in 1926.

Work on the white fir bulletin to date has been confined in this Region to the preparation of a report in memorandum form, bringing together all the available data on the problem. The purpose of this report was to provide the Laboratory and the co-operating Region with all the available information on white fir in Region 1 for help in preparing the properties and use bulletin. Region 5 has been assigned to co-operate with the Laboratory in preparing the data for publication.

The preparation of a manuscript on the utilization of lodgepole pine, to be published as a deparmental bulletin, was assigned to Mr. Whitney of the Region 1 office of Products. The project was initiated in 1927. Field work on the project is completed and some work done on the analysis of the data.

PROGRESS DURING 1930 — Western Larch Bulletin. Review of the completed manuscript with Johnson at the Laboratory in May, 1930. Collection in May, 1930, of additional photographs to illustrate the bulletin.

White Fir Bulletin. No work done in 1930.

Lodgepole Pine Bulletin. Completion of field work. Whitney visited some characteristic lodgepole stands in Oregon and Washington and interviewed operaters and users. Manufacturers and consumers of lodgepole pine products in Montana were also interviewed by Whitney on a second field

trip to determine causes of decline in the consumption of lodgepole pine in the Butte and Great Falls mining and reduction districts. Work on preparation of the bulletin was commenced in the early winter.

FURTHER WORK

Western Larch Bulletin. Review of completed manuscript.

White Fir Bulletin. Preparation of certain parts of this bulletin as regards the white fir problem in Region 1.

Lodgepole Pine Bulletin. Completion of the manuscript.

DATE OF COMPLETION

1931. All bulletins.

ASSIGNMENT

Western larch and white fir--Bradner.
Lodgepole pine--Whitney.

RP
Lumbering
Logging Output Studies

December 20, 1930.

PROJECT — Preparation of the Logging Output Bulletin.

SCOPE — To prepare for publication as a departmental bulletin the data and results obtained in the Regional logging output studies.

STATUS — The original manuscript was prepared by Klobucher and Girard and submitted for publication shortly after they left the Service in 1923. A bulk of the field work was completed in 1923, although additional studies were made in 1927 and 1928. Since that time two manuscripts have been submitted for publication but further revision was desired. To meet current needs of the Regional organization, results were published in mimeograph and photostat form as the "Inland Empire Logging Output Handbook." A considerable distribution of this handbook was made to the lumber industry. A third manuscript is being prepared.

PROGRESS DURING 1930 — The revision of the manuscript was completed in the fall of 1930. All tables and computation were corrected to 1929 costs. The new manuscript was reviewed by Mr. Girard and Mr. Klobucher early in December and approved by them. The manuscript was also reviewed by members of the Region 1 Office and then transmitted to the Washington Office for editing and final acceptance.

FURTHER WORK — Edit and approval by Washington Office. Publication.

DATE OF COMPLETION — 1931.

ASSIGNMENT — Bradner.

RE
Production
Annual Lumber Census

December 20, 1930.

PROJECT — Annual lumber census.

OBJECT and SCOPE — To obtain by a canvass of all the sawmills in Montana and Idaho the annual figures on the production of lumber, lath, and shingles. In odd years a canvass of all producers of forest products (includes besides lumber, hewed ties, mining timbers, poles, posts, etc.) is made. The value of the products is also obtained.

STATUS — This project is handled each year for the States of Idaho and Montana in co-operation with the Bureau of the Census. Mailing lists used as a basis for this work are kept up to date through the co-operation of all Forest Supervisors in these two States. Some information covering changes of ownership and new mills is also obtained from other sources. The lumber cut figures for each mill are entered on separate cards at the Regional Office, annually. A preliminary press notice covering the lumber production for the two States is issued upon the completion of the canvass.

DATE OF COMPLETION — An annual project.

ASSIGNMENT — Whitney.

RE
Lumbering Costs
Logging and Manufacturing

December 20, 1930.

OBJECT and SCOPE

To obtain the average annual logging and manufacturing costs for the Region. Such cost figures are used in making stumpage appraisals and in arriving at production cost figures in many lines of Products and Logging Engineering work.

STATUS

Detailed logging and manufacturing costs are obtained currently from between 30 and 35 of the larger lumber companies in the Region. These data are listed in detail, summarized by species and mill groups, and averaged in a report which is distributed within the Service and to the co-operating companies.

DATE OF COMPLETION

An annual project.

ASSIGNMENT

Bradner and Neff (Regional Logging Engineer).

RE
Prices

December 20, 1930.

STATUS

Current price records are secured for:

1. Lumber - mill
2. Lumber - retail
3. Stumpage
4. Logs
5. Cedar products
6. Ties

Lumber prices obtained from the Western Pine Manufacturers' Association under contract are compiled in quarterly and annual reports. The prices are averaged by species and grades. The retail lumber and cedar products prices are issued in quarterly reports. Log and tie prices are collected and reported semi-annually. Stumpage prices from all sources in this Region are collected and compiled annually. Under an expansion of this study stumpage price data on file dating back to 1906 will be assembled, grouped and summarized for six major agencies.

DATE OF COMPLETION

These are annual projects.

ASSIGNMENT

Mrs. Bullard and I. V. Anderson.

R. G.
Investigative Program
1930

Project:	Carrying Capacity - Custer.
Scope:	Continuation on a modified scale of the Poker Jim Experimental Pasture.
Status:	Initiated 1925. Six years' data already obtained. Carrying capacity, salting, and forage production features to be continued.
Further Work:	To be continued until the necessary information is obtained.
Date of Completion:	Indefinite.
Assignment:	A. A. Simpson.

R. G.
Investigative Program
1930

Project: Carrying Capacity - Helena.

Scope: Crow Creek Experimental Pasture, 1261 acres. To determine the forage acre allowance, salt requirements, improved methods of distribution of stock, possibilities of increase in calf crop by pasture breeding, the degree of utilization which the forage plants on this range can withstand.

Status: Initiated 1928. Suitable check enclosures have been constructed to supplement special studies. Scales are available to take weights of livestock in order to determine gains and the actual money value of a forage acre. Co-operative agreement has been concluded which will insure the same herd of cattle for a five-year period. Three years' data have been secured.

Further Work: It is intended to continue this project over a period of at least five years in order to obtain conclusive information.

Date of Completion: Indefinite.

Assignment: H. H. Hendron.

R. G.
Investigative Program
1930

Project: Artificial Reseeding. Lewis and Clark.

Scope: To determine the value of reseeding depleted ranges by artificial means in order to re-establish a forage crop. To develop the most efficient methods of reseeding and to determine costs.

Status: Lewis and Clark Forest. Seven areas seeded.

	1928 Cultivation
1. 2 acres, park in lodgepole pine type.	Brush harrow
2. 1¼ acres on salt-ground area.	None
3. ½ acre, open park type.	Brush harrow
4. 1⅛ acres " " "	" "
5. 1½ " " " "	None
6. 7 " " side hills - 1" fresh snow.	No harrowing
7. Fenced plot 16 ft. square - ground cultivated and seed covered by dragging.	

Five species of grass seed were used.
1. Bromus inermis - Hungarian brome.
2. Dactylis glomerata - Orchard grass.
3. Festuca elatoir - Meadow grass.
4. Phleum pratense - Timothy.
5. Melilotus officinlis - Yellow sweet clover.

Fourteen pounds of mixed seed were used per acre in areas 1 to 6 inclusive. On plot 7 species #1-3-4-5 were sown separately on four equal areas inside the inclosure.
Areas 1 to 5 inclusive will be protected from grazing use for two years.
Area 6 is grazed heavily by elk each spring.
Plot 7 will be protected permanently.

Further Work: Field checks on germination of seed and survival of plants and comparative results of planting methods on different areas. After protection, period checks on resistance to grazing of established species.

Date of Completion: Indefinite.

Assignment: Sam F. Harris.

R. G.
Investigative Program
1930

Project: Handling Stock. Gallatin.

Scope: To determine improved methods of managing sheep on the range, the usability of various types of range, forage requirements of sheep by types of range, gain in weight on the range, losses, practicability of requirements now imposed on permittees in the management of stock and the co-ordination of the summer grazing period with the yearly cycle of operation.

Status: Initiated 1927. Co-operative with Montana State College. Allotment on Bridger Division of the Gallatin Forest. Used by College band of sheep.

Grazing survey and management plan completed in 1928. Data on gains and losses available for 1927-28. Complete data obtained for 1929 and 1930.

Further Work: Continuation of project as outlined with gathering of technical data to be done co-operatively between Gallatin Forest and Regional Office.

Date of Completion: Indefinite.

Assignment: A. H. Abbott.

CONTINUATION PROJECT
Outlined Heretofore.

Project:	The seed factor in the management of ranges.
Scope:	As heretofore.
Status:	Over 800 samples have been tested as outlined heretofore.
Further Work:	A continuation of the work outlined. This year the viability analyses will commence, since collections are available varying from 1 to 5 years in age.
Date of Completion:	Probably 1932.
Assignment:	Lommasson and assistants on collection. Spaulding and Park, Flock and Jackson on tests and compilation.

R. G.
Investigative Program
1930

Project:	The growth, development, and extension of range plants.
Scope:	A study of the growth requirements, the development of the plant, its flowering and seeding, and the capacity for extension of the range plants of economic importance in this Region.
Status:	Initiated 1931. This project was to have been initiated in 1930 at the University of Montana, but owing to lack of funds it was necessary to change the location of the experiments to the Forest Service Remount Station near Missoula. Active work will begin in the spring of 1931.
Further Work:	The completion of the project.
Date of Completion:	Indefinite.
Assignment:	Lommasson and Spaulding.

RS (O)
Radio Telephones

December 10, 1930.

PROJECT: Adaptation and development of radio telephone equipment for field use. Classification: V, c, 7.

SCOPE: To secure readily portable radio sending and receiving sets that could be used to supplement or, if practicable, to supplant the grounded line telephone system now in use on the National Forests. To find or develop radio directing apparatus that could be used by the men searching for obscure fires.

STATUS: Much information has been collected from manufacturers, Bureau of Standards, Army, Navy and other sources. Final conclusions have not been reached but both portable and central station instruments have been developed which gave encouraging results in service under field conditions last summer. No formal progress report on the project is available at this time.

RESULTS: A field trial was conducted on the Columbia National Forest in Washington during the summer of 1930. Results were encouraging but not final.

FURTHER WORK: Work is being continued to improve performance of the central radiophone station, further to eliminate interference noises and to answer questions in regard to central station saturation point.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: D. L. Beatty, Operation, with assistance from R-6.

RS (0)
Lightning Fires and Geology December 10, 1930.

PROJECT: The relation of the occurrence of lightning fires to underlying geological formations.

SCOPE: To determine for the only locality in the western part of R-1 for which a detailed geological map is available, the relationship, if any exists, between underlying geological formations and the occurrence of lightning-caused forest fires.

STATUS: For the Coeur d'Alene mining district in the vicinity of Wallace, Idaho, a detailed geological map compiled by the U. S. Geological Survey has been secured. The location and year of origin of each lightning fire for the period 1911 to 1926, both inclusive, has been superimposed on the geological map. The area of each formation has been determined by 1,000-foot zones of altitude above sea. The number of lightning fires per unit of area in each 1,000-foot zone of each formation is to be determined and correlated. An attempt is to be made also to correlate forest types and cover conditions on the area with these data.

RESULTS: No results other than the progress mentioned above have been attained to date. Only a very little progress has been made during the past year.

FURTHER WORK: Completion of the study as outlined above.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Flint, possibly with some incidental assistance from Experiment Station Staff.

RS (0)
Small Tractors

December 10, 1930.

PROJECT: Use of small tractors for fire-trench construction. Classification: V, c, 3.

SCOPE: To determine to what extent, if any, an inexpensive, light-weight tractor might take the place of draft horses in fire-trench construction and in forest trail construction and maintenance. In proportion to the short time they are used each year horses are costly to maintain.

STATUS: First tests were made in spring of 1927, others in fall of 1928. Three makes of one-horse-power tractors have been tried: the Beeman, the Iron Horse and the Flextred. The Beeman has been eliminated as unsuited to this work. Of the other two the Flextred seems the more promising, but both appear worth some further consideration. Reports on all three trials are on file in Operation, and one Iron Horse and one Flextred have been purchased for further trials. A newer and heavier model Flextred given some trial in R-6 is said to be a more promising machine than the old one.

RESULTS: One of the machines was remodelled as planned, but no adequate field test was secured.

FURTHER WORK: During the coming season endeavor to secure field trials of this equipment on going fires. Test out any other promising tractors that may appear.

DATE OF COMPLETION: Fall of 1931, possibly later.

ASSIGNMENT: Flint and field men on several Forests.

RS (O)
Adequate Fire Control

December 10, 1930.

PROJECT: Adequate forest fire control in the Northern Rocky Mountain Region. Classification: V, c, 7. (Also listed by Experiment Station as Pf, A-3, R-1.)

SCOPE: To define adequate fire control for the Region from an economic standpoint. To devise suitable written plans to direct its practical achievement on National Forest ranger districts.

STATUS: Fairly complete statistics of fire occurrence, causes, losses, and cost of control for Region 1 National Forests have been gathered over a period of 20 years. Considerable compilation of these data has been done. Incomplete preliminary data dealing with fire control costs and losses on other forms of property have been secured and used for comparison. A statement of the problem and data was published in Journal of Forestry for May, 1928. Sample ranger district fire plans based on these data and on recent past experience have been formulated and circulated in mimeograph form for criticism and comment.

RESULTS: Workable plans based on current knowledge have been completed and checked for about 50 ranger districts out of a total of 94 that call for such plans.

FURTHER WORK: It is recommended that this no longer be carried as a separate project in this program but work along this line will continue in the field and in Operation on an expanded scale, to include other phases and methods of attack. Much of this project appears to be more an administrative than a research project.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Flint and Hornby, Operation.

RS (0)
Use of Explosives

December 10, 1930.

PROJECT: Use of explosives for fire-trench construction.
Classification: V, c, 3.

SCOPE: To determine whether the cost of fire-trench construction could be lessened and construction materially speeded up by the use of high explosives.

STATUS: First tests were made in spring of 1926 with standard Cordeau-Bickford manufactured by Giant Powder Company. Cordeau-Bickford is a thin lead tube 6 mm. in exterior diameter filled with compressed T.N.T. It is exploded by an ordinary dynamite cap and fuse, the explosion progressing along the tube at a rate of about 15,000 feet per second and expending its energy in all directions with relatively great force. Laid and exploded on top of undisturbed forest duff averaging about 2 inches in thickness, under a stand of green Douglas fir and intermingled species, the charge opened an imperfect trench averaging about 8 inches wide entirely through the duff in some places, only partially through it in others. After several tests the conclusion was reached that the loose structure and light weight of the duff layer did not offer sufficient resistance to the force of the explosion to secure removal of a sufficient quantity of duff to make an effective fire trench. Results were reported to the manufacturer, who freely offered his assistance. The latest development is a 7 mm. countered Cordeau which is considerably more powerful than the other, also heavier and more costly.

RESULTS: No adequate field test has been made of the latest product.

FURTHER WORK: Conduct other tests in other kinds and depths of duff. Secure a sufficient number of trials on going fires to determine the practical possibilities of this method of opening trench as compared to other methods. Submit an appropriate report.

DATE OF COMPLETION: Fall of 1931.

ASSIGNMENT: Flint and field men on several Forests.

RS (0)

Aerial Photographic Mapping — December 10, 1930.

PROJECT: Aerial photographic mapping. Classification: V, c, 7.

SCOPE: To determine by experimental use the possibilities of aerial photography as a means of building up drainage, culture, and cover or type maps of forested mountain areas for fire control and other purposes. To keep abreast of progress in this method of map making and adapt new developments to practical forest use.

STATUS: Work commenced with the mapping of a trial area of 64 square miles on relatively easy topography on the Kaniksu Forest in the fall of 1926. A mosaic of composite photograph of the area and a line map were compiled. Results seemed to warrant the undertaking of larger and more difficult areas. Several badly mapped areas of bold relief have since been photographed on the Nezperce, Clearwater, Kaniksu, and Kootenai National Forests. Compilation is far behind due to shortage of funds. Some difficulties have been encountered in the flying for large unimproved areas. Serious problems are encountered in the elimination of distortion in the pictures due to great topographic relief. Apparently, but very little work of this kind on areas of rough topography has been undertaken by other agencies. Methods must be developed largely by trial and experience. Progress has been made during this year in improving methods of compilation.

RESULTS: Highly encouraging results have been secured. Photography on about 620 square miles has been completed and a preliminary map of about 240 square miles has been completed and put in service.

FURTHER WORK: Complete the compilation of about 2300 pictures recently taken. Check the maps obtained by some ground survey work in the field. Test out in the field the possibilities of direct use of the pictures for resource surveys and intensive utilization. Secure additional pictures next season if needed to develop the method.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Yule, Engineering; Flint, Operation. Technical advice will continue to be secured from Eastman Kodak Company, Fairchild Aerial Camera Corporation, U. S. Army Air Corps, and U. S. Geological Survey.